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Elaine P. Downing, et al

State University College

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16. Abstract

Five hundred ninty-six (596) papers concerning biological aspects of Lake Ontario and influent tributaries were reviewed and abstracted. Each paper was cross-indexed by author, geographic area of lake and/or tributary in which study was performed, organism, habitat niche and techniques and instrumentation. In addition, a list of addresses for the authors and agencies ~~was~~ included along with other possibly pertinent references which the authors were not able to secure and review within the time limitations of the grant. (EPA abstract)

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ANNOTATED BIBLIOGRAPHY OF LAKE ONTARIO LIMNOLOGICAL AND RELATED STUDIES

Vol. II - BIOLOGY

By

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Project 16120 HVR

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I. INTRODUCTION

The purpose of this study, which was sponsored under grant # 16120 HVR from the U. S. Environmental Protection Agency, was to provide a reference that would be of aid to those individuals and/or agencies, planning or initiating limnological research on Lake Ontario and/or its tributaries, particularly those activities which are part of the International Field Year on the Great Lakes (1972-74). The task was divided on the basis of disciplines into three (3) sections - physical, chemical and biological. This paper is the final report from the latter.

The holdings of libraries in both the United States and Canada were surveyed. Each pertinent reference was abstracted and examined with respect to the parameters measured, techniques employed and the location(s) in which the study was conducted. In addition, the last known address of the agency or senior author was noted for inclusion of locating the author if further communication is desired.

Unless otherwise noted, the papers cited in the annotated list are located in Buffalo.

Due to limitations in time, we were unable to secure copies of a few references that may contain information relative to Lake Ontario. These have been included in this paper.

Comments concerning this work are welcome and appreciated.

II. SUBJECT INDEX

The number following each, refers to the number of the paper listed in Section II. Lake Ontario was divided into eighteen (18) regions, which are shown in Figure 1. The number nineteen (19) refers to lake-wide studies; while twenty (20) concerns tributaries to the lake. For the identification of the specific stream or river in question, see the abstract.

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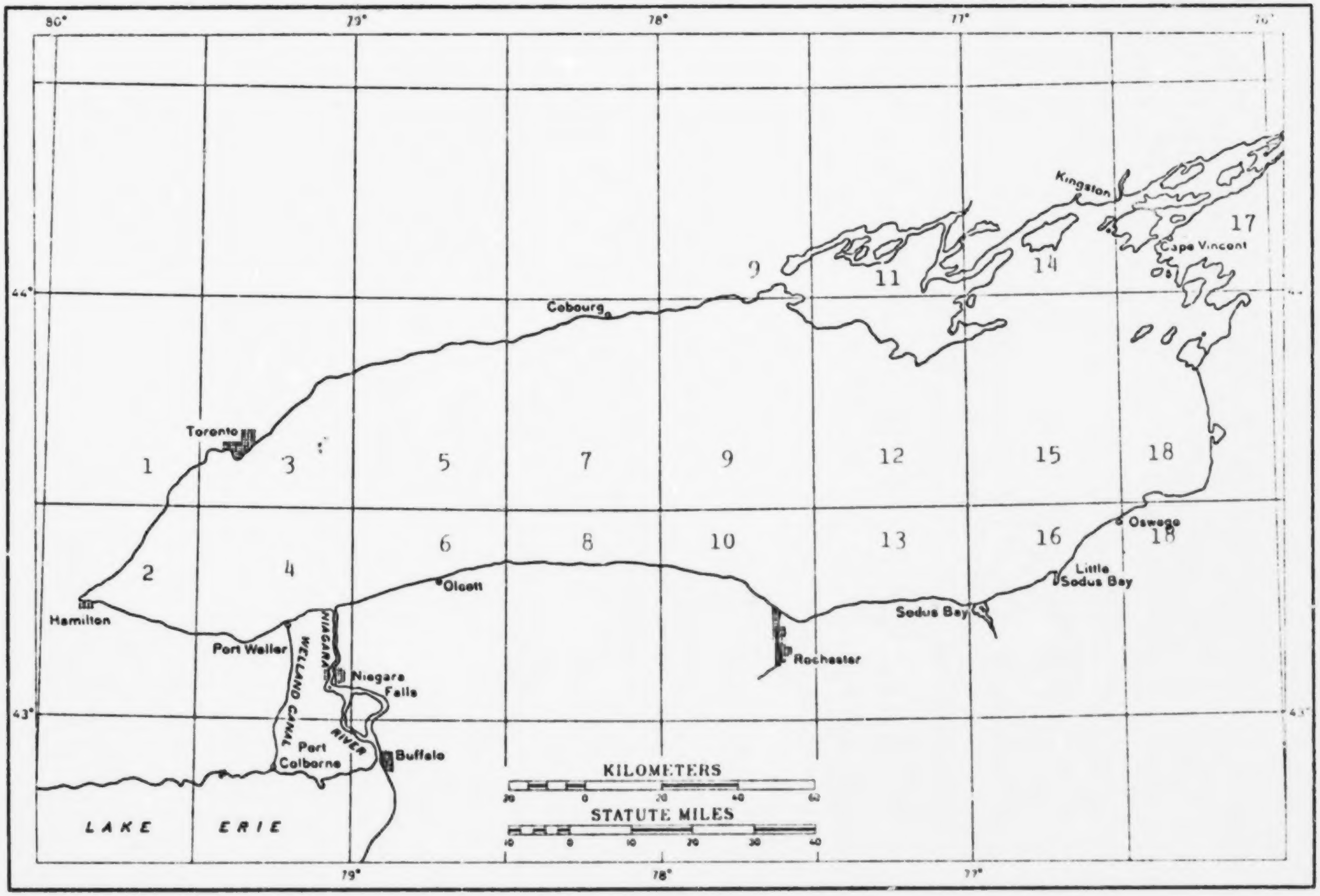
FIGURE 1 - MAP OF LAKE ONTARIO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79°
78°
77°
76°
44°
43°
1
2
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10
11
12
13
14
15
16
17
18
18
Toronto
Hamilton
Port Weller
WELLAND CANAL
NIAGARA
RIVER
Niagara Falls
Port Colborne
Buffalo
Olcott
Cobourg
Rochester
Sodus Bay
Little Sodus Bay
Oswego
Kingston
Cape Vincent
LAKE ERIE
KILOMETERS
20
0
20
40
60
STATUTE MILES
10
0
10
20
30
40

19 - Lake-Wide   20 - Tributaries (see abstract for specific stream(s))

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III. ABSTRACTS

The location of those papers not found in Buffalo and available through the Great Lakes Lab are given in parenthesis at the end of the abstract.

1. Adamstone, F. B. 1924. The distribution and economic importance of the bottom fauna of Lake Nipigon with an appendix on the bottom fauna of Lake Ontario. Univ. Toronto. Studies Biol. Series No. 25: 34-100. (Pubs. Ont. Fish. Research Lab. No. 24).

On October 3, 1922, a series of dredgings were made in Lake Ontario between Toronto and the mouth of the Niagara River. The Mollusca were composed mostly of Pelecypoda, but a number of specimens of dead Gastropod shells were also obtained. Representatives of the Chironomidae, Odonata, Amphipoda, Oligochaeta and Nematoda were also found. The samples obtained indicate that Lake Ontario has a rich and varied bottom population. (Univ. of Toronto Zool. Library).

2. Agassiz, L. 1857. On some young gar-pikes from Lake Ontario. Proceedings Boston Soc. Natural Hist. 6: 47-48.

Agassiz, L. 1957. On some young gar-pikes from Lake Ontario. American Journal Science & Arts (2nd series). 23: 284.

Contains brief notes on morphological characters, affinity to reptiles and mode of feeding of several living young gar-pikes from Lake Ontario.

3. Almendinger, W. A. 1949. Observations on American Brant along the Niagara River. Prothonotary. 15(11): 71.

This paper includes information observations of an American Brant on the Niagara River, November 20, 1949, the first observation in the city limits since 1889.

4. Amsler, G. 1934. Report of the Division of Protection and Legislation. Transactions American Fisheries Society. 64: 38-39.

This is a report of legislative action concerning fish in the United States. New York reduced the limit on lake trout from 10 to 6,shortened the open seasons on that species one month and whitefish two months. The use of goldfish and carp were prohibited for use as bait and the size of minnow nets was reduced to 36 square feet. (Canada Centre for Inland Waters).

5. Anderson, A. W. and E. A. Power. 1950. Fishery statistics of the United States, 1947. U. S. Fish and Wildlife Service, Statistical Digest 21. 285 p.

This report contains a review of the fishery statistics for the year 1947 which includes data on the volume of the catch of fishery products and their value, employment in the fisheries, quantity of gear operated, the number of fishing craft employed in the capture of fishery products and certain information on the volume and value of the production of manufactured fishery products and by-products.

Section 7 covers the statistical surveys for the lake fisheries with tables summarizing the United States and Canada. With regard to the catch in Lake Ontario, 20 species accounted for 463,000 pounds with a value of $81,064 in the United States and 11 species plus an unclassified group accounted for 2,001,700 pounds in Canada. (Univ. of Toronto Zool. Library).

6. Anderson, D. V. and D. Clayton. 1959. Plankton in Lake Ontario. Ontario Dept. Lands and Forests, Physics Research Note No. 1. Unnumbered.

Presented in this note is a few figures on the total quantity (standing crop) and species composition of larger phytoplankton and zooplankton in Lake Ontario. Samples were taken on a lake-wide cruise. (Canada Centre for Inland Waters).

7. Anon. 1878. Introduction of Shad into Lake Ontario. Report U. S. Comm. Fish. 6: 937.

A small article on the success of a Mr. Seth Green on cultivating shad in Lake Ontario. Mentioned in the article is a male shad, weighing five and a half pounds, which was caught in a gill net, six or seven miles out in Lake Ontario at the mouth of the Salmon River.

8. Anon. 1917a. A glance at our fisheries. Can. Fisherman. 4(8): 326.

Briefly discusses the fish resources of Canada starting with the St. Lawrence River, then each of the Great Lakes, next up to the North Country, and finally the Pacific coast. With reference to Lake Ontario, the principal fish are listed as whitefish, trout, bass, pickerel, etc. (Univ. of Toronto Main Library).

9. Anon. 1917b. Report on fish hatchery at Belleville, Ontario. Can. Fisherman. 4(12): 505.

Report from the Thurlow Hatchery near Belleville, Ontario on the successful whitefish egg - collecting season. (Univ. of Toronto Main Library).

10. Anon. 1922a. Proposed minimum sizes for fish. Can. Fisherman. 9(4): 77.

Gives the sizes below which fish are not to be taken. The size limit for ciscoe and lake herring from Lake Ontario is to be not less than 8 ounces. (Univ. of Toronto Main Library).

11. Anon. 1922b. Introduction of Pacific salmon in the Great Lakes. Can. Fisherman. 9(4): 78.

Brief note on the occurrence of the spring or quinnat salmon in the Bay of Quinte as a result of planting. (Univ. of Toronto Main Library).

12. Anon. 1922c. Place doesn't agree with shad. Can. Fisherman. 9(7): 150.

Note on the exceptionally large dead fish piles along the shore of Lake Ontario. (Univ. of Toronto Main Library).

13. Anon. 1922d. How Ontario benefits by fish culture. Can Fisherman. 9(8): 173.

A discussion of the acclimatization of spring salmon, *Oncorhynchus tschawytscha*, in Lake Ontario. Approximately 825,000 eggs were furnished by the United States and the resultant fry were placed in suitable tributaries of Lake Ontario. Included a brief mention of the occurrence and description of spring salmon taken near Youngstown, New York and in the Bay of Quinte.

The indications point to the fact that this valuable food fish may become fully acclimatized in its new environment. (Univ. of Toronto Main Library).

14. Anon. 1924a. The whitefish resources of our lakes. Can. Fisherman. 11(3): 62.

A note on the successful whitefish fishery in Lake Ontario as a result of stocking operations. (Univ. of Toronto Main Library).

15. Anon. 1924b. Erie fishing opens well. Can. Fisherman. 11(4): 90.

Brief mention is made concerning the good whitefish yields at Bronte, on Lake Ontario. (Univ. of Toronto Main Library).

16. Anon. 1924c. Ontario hatchery production. Can. Fisherman. 11(5): 108.

Reports the distribution of 77,000,000 whitefish fry from the Thurlow Hatchery into Lake Ontario and the collection of over 70,000,000 pickerel eggs from fish caught in the Napanee River. (Univ. of Toronto Main Ligrary).

17. Anon. 1924d. About the Great Lakes. Can. Fisherman. 11(5): 108.

Contains a series of brief notes on various aspects of the fishing industry in the Great Lakes. With reference to Lake Ontario, excellent catches of whitefish are reported from several points. (Univ. of Toronto Main Library).

18. Anon. 1924e. Revival of whitefish. Can. Fisherman. 11(5): 109.

A brief note on the successful whitefish catch in Lake Ontario due to restocking operations. (Univ. of Toronto Main Library).

19. Anon. 1924f. Spring salmon in Lake Ontario. Can. Fisherman. 11(5): 123.

A brief note on the take of spring salmon in different stages of development and growth up to 30 lbs. in weight as a result of the systematic stocking of Lake Ontario with spring salmon of the Pacific coast. (Univ. of Toronto Main Library).

20. Anon. 1924g. Annual meeting of American Fisheries Society. Can. Fisherman. 11(11): 299-302.

Contains a summary of the proceedings with notes on various aspects of the fishing industry. With reference to Lake Ontario, the whitefish fishery is cited as an example of the usefulness of hatchery operations. The question was raised, however, as to whether the recovery of the fisheries in Lake Ontario could not have been brought about equally by the enforcement of adequate restrictions. (Univ. of Toronto Main Library).

21. Anon. 1924h. Ontario fishing regulations amended. Can. Fisherman. 11(8): 229-230.

The amended fishing regulations that apply to Lake Ontario are as follows: Sec. 12 size limits - ciscoes or lake herring from Lake Ontario cannot be taken if less than 8 ounces; Sec. 13. restriction, Bay of Qunite - cites fishing regulations for the months of June, July and August. (Univ. of Toronto Main Library).

22. Anon. 1924i. Looks like late season in Great Lakes. Can Fisherman. 11(11): 309-310.

Notes on the various fishing operations in the Great Lakes are given. With reference to Lake Ontario, 560,000,000 fry were put into the waters for reproduction, the Pacific salmon was successfully introduced into the lake, fully-matured sockeye have been caught in Lake Ontario, and an average of 200,000 young sockeye have been released each year into Lake Ontario. (Univ. of Toronto Main Library).

23. Anon. 1925a. Sudden cold hits Erie fisherman. Can. Fisherman. 12(1): 17.

Contains a brief note on the good fishing season on Lake Ontario despite the rough weather. (Univ. of Toronto Main Library).

24. Anon. 1925b. News and notes of inland waters. Can. Fisherman. 12(4): 92-93.

Reference to Lake Ontario is made in connection with a large catch of burbet caught three miles off shore at Belleville and also regarding above average catches at Port Credit on Lake Ontario. (Univ. of Toronto Main Library).

25. Anon. 1925c. Canada's commercial fisheries. Can. Fisherman. 12(4): 99-105.

Contains an overall view of Canadian fisheries including fishing areas, regional divisions, economic value and fish resources. The only reference to Lake Ontario concerns the occurrence of the Atlantic salmon in Ontario waters. (Univ. of Toronto Main Library).

26. Anon. 1925d. Good haul of whitefish. Can. Fisherman. 12(5): 119.

Report by fishermen on the poor catches at Bronte, Lake Ontario versus good catches in the Bay of Quinte. (Univ. of Toronto Main Library).

27. Anon. 1925e. Around the Great Lakes. Can. Fisherman. 12(7): 210.

Contains several brief articles on various aspects of the fishing industry. An exceptionally large haul of carp was reported from Hamilton Bay, a large number of fish were caught in Belleville Bay, and a poor fishing season was reported for the Bay of Qunite. (Univ. of Toronto Main Library).

28. Anon. 1925f. Around the Great Lakes. Can. Fisherman. 12(12): 367-368.

Contains various brief articles on the fishing industry of the Great Lakes. Included therein is a report from Lake Ontario on the average fishing conditions there. (Univ. of Toronto Main Library).

29. Anon. 1928a. Around the Great Lakes. Can. Fisherman. 15(5): 154.

A brief note on the good fishing and exceptionally fine catches of perch, pike and pickerel in Lake Ontario. (Univ. of Toronto Main Library).

30. Anon. 1928b. Around the Lakes. Can. Fisherman. 15(9): 35.

A short article concerning the first-rate conditions of the trout and whitefish in Lake Ontario, although the quantities caught could be better. (Univ. of Toronto Main Library).

31. Anon. 1928c. Herring and perch run on lakes. Can. Fisherman. 15(12): 37.

A brief paragraph on Lake Ontario concerns the magnificant run of herring, which was unfortunately interrupted by rough weather. (Univ. of Toronto Main Library).

32. Anon. 1946. Salmon once in Lake Ontario. Hunting and Fishing in Canada. 12(6): 18, 32.

Gives an account of the teeming numbers of salmon which used to inhabit the Ganaraska River, which flows into Lake Ontario at Port Hope. (Toronto-Royal Ontario Museum).

33. Anon. 1969. Great Lakes fishes. In: D. V. Anderson (Ed.). The Great Lakes as an Environment. Great Lakes Institute, Univ. Toronto. Appendix 6 (1). pp. 32-39.

Annotated list of the principal commercial and sport fishes in the Great Lakes including information on importance and distribution of each fish in the fishery. Statistics in graph form a comparison to total U. S. versus Canadian Great Lakes commercial fish production 1914-1961 and Great Lakes landings of all species by lake, 1946-1961. (Canada Centre for Inland Waters).

34. Anon. 1970. Kokanee: The sporting goldfish. Limnos. 3(4): 18-21.

The introduction of the kokanee, a freshwater sockeye salmon, by the Dept. of Lands and Forests of Ontario was attempted in Lake Ontario and Georgian Bay. These plankton feeding salmon have been fairly successful at establishing themselves in Georgian Bay but the Lake Ontario program was unsuccessful.

35. Appleby, A. G. and Ralph O. Brinkhurst. 1970. Defecation rate of three tubificid oligochaetes found in the sediment of Toronto Harbour, Ontario. Journal Fish. Research Board Canada. 27: 1971-1982.

The defecation rate of three tubificids is affected by temperature but the effect differs from species to species. Information on defecation rate and weight changes at each experimental temperature suggests an optimum temperature range of 14°C for *Peloscolex multisetosus*, 18°C for *Tubifex tubifex* and greater than 20°C for *Limnodrilus hoffmeisteri*. Downward trends of defecation rate with time were recorded for *P. multisetosus*, but these were probably due to lowered activity prior to the observed mortality. Upward trends in defecation rate with time in *L. hoffmeisteri* may indicate continuing acclimation to experimental conditions beyond their 10 to 14 day duration, or a need to process increasing amounts of less nutritious mud because of selective feeding or the richer fractions at the beginning of the assay period. Data on the relative abundance and distribution of species in Toronto Harbour is used to estimate defecation rates of the tubificid populations in the field.

36. Atkins, Charles G. 1874. On the salmon of eastern North America, and its artificial culture. U. S. Commission Fish and Fisheries. Report for 1872-1873, Part 2, App. B. pp. 226-337.

The above contains a discussion of restocking operations and includes the following sections: Salmon Culture from Imported Spawn, Salmon Breeding on the Penobscot, Tabular Statements Embodying Observations on Salmon and Salmon Rivers in Maine, Local History of Salmon and Salmon-Fishing in New England Rivers and Notes on the Growth and Migrations of Salmon.

The following references were made with respect to Lake Ontario. In the spring of 1870 the first salmon from Lake Ontario were introduced into Maine and in 1871-1872 the Commission bought eggs of Ontario salmon for placement in Housatonic, Farmington, Shetucket and Quinnebaug Rivers.

37. Atwater, W. O. 1883. Report of progress of an investigation of the chemical composition and economic values of fish and invertebrates used for food. U. S. Commission Fish and Fisheries. Report for 1880, Part 8, App. D. pp. 231-285.

Contained in this paper is an analysis of fish and invertebrates in relation to their nutritive value. Salmon trout or Mackinaw trout and *Salvelinus namaycush* were listed as occurring in Lake Ontario.

38. Atwater, W. O. 1892. The chemical composition and nutritive values of food-fishes and aquatic invertebrates. U. S. Commission Fish and Fisheries. Report for 1888, Part 16. pp. 679-868.

The investigation includes (1) chemical analyses of the flesh of American food-fishes and invertebrates; (2) experiments upon the digestibility of the flesh of fish and (3) studies of the chemical constitution of the albuminoids of the flesh of fish.

Analyses were made on the flesh of 123 specimens of American fishes belonging to 52 species, of 3 specimens and 2 species of European fishes and of 64 specimens representing 11 species of American mollusks, crustaceans, etc.

Specimens listed as occuring in Lake Ontario were the pickerel (p. 706) and lake or Mackinaw trout (p. 709).

Austin, Thomas - See: Willis L. Tressler, No. 558, 559.

39. Bailey, L. W. 1924. An annotated catalogue of the diatoms of Canada showing their geographical distribution. Contributions Canadian Biology, New Series. 2(2): 33-67.

The paper lists the different diatoms that have been observed in Canada as well as the location where the diatoms have been found. Mentioned specifically as being found in Lake Ontario is *Epithemia gibba*.

40. Bailey, L. W. 1925. An annotated catalogue of the diatoms of Canada showing their geographical distribution. Contributions Canadian Biology , New Series. 2(2): 31-68.

This paper attempts to list some of the diatoms of Canada and their geographical distribution. Due to the enormous extent of area, it is not complete but rather a basis for further investigation. Not much is mentioned concerning Lake Ontario although a few species are mentioned as occurring there.

41. Baillie, J. L. 1958. Barrows goldeneye and pomarine jaeger at Niagara Falls. Prothonotary. 24(3): 1958.

Presented here is information on observations on a barrows goldeneye and pomarine jaeger which were chilled by going over Niagara Falls. These species are rare in this area.

42. Baldwin, Norman S. 1952. Great Lakes fisheries problems. Univ. Toronto, Dept. Zoology. 6 p. Unpublished.

The statistics of the Great Lakes fisheries indicate a decline in the catch of most valuable commercial species during the last thirty years. It is generally believed that this decline is due to heavy fishing or unwise fishing practices, but there is some doubt that the decline can be attributed to these factors entirely. One thing is certain, there is no clear understanding of what regulations or other management techniques are required to give a sustained and economic yield of fish.

There are three basic questions which are considered in this report regarding the Great Lakes fisheries: (1) What are the factors controlling the abundance of certain commercial and game species?, (2) What use can be made of large stocks of fish that are not presently exploited? and (3) What steps can be taken to expedite international control of the fisheries? (Toronto, Ontario Fish. Research Lib. Zoology Library).

43. Baldwin, Norman S. 1958. Fisheries. Ontario Dept. of Lands and Forests, Division Research Tech. Series. Annual Research Progress Rept. 1956-57. pp. 31-36.

Presented here is a short account of fisheries research in Canada. On Lake Ontario 4,829 whitefish were sampled from 65 commercial catches. Tagged whitefish recoveries were very high (51%) indicating high exploitation of the populations. The undersize whitefish in the catches were abundant. Tagged lake trout recoveries indicate a high survival of New York State plantings. (Ontario Dept. Lands & Forests Maple).

44. Baldwin, Norman S. 1965. Lampreys in the Great Lakes. Ward's National Science Bulletin. 4(28): 1-7.

This article described the life cycle, distribution and attempts to control the five species of lampreys (petromygonidae) which now exist throughout the Great Lakes. A brief description of the advance of these parasites is also given. (Toronto, Ontario Fish. Research Lib. Zoology Library).

45. Bams, Robert A. 1959. Review of the Sea Lamprey Problem. Proceedings Can. Committee Freshwater Research, 12th Meeting. Appendix D: 14-15.

Sea lampreys appeared very early in Lake Ontario. The first Lake Erie record was in 1921 and by 1932 evidence that they were breeding in Lake Erie tributaries was obtained. A brief life history is described as well as methods for control. (Toronto, Ontario Fish. Research Lib. Zoology Library).

46. Barnett, J. M. 1971. Ashbridges Bay. Ontario Naturalist. 9(4): 24-26.

Ashbridges Bay has undergone and is undergoing vast changes that will drastically effect the wildlife of the area. A history of the area since 1793 is presented with many references to the changes and problems experienced in the waterfowl populations. Some descriptions of early fishing in the bay is mentioned.

Bastien, J. A. P. - See: A. D. Tennant, No. 550.

Batoosingh, E. - See: R. O. Brinkhurst, No. 75.

47. Bean, Barton A. and Alfred C. Weed. 1911. Notes on the genus *Lepomis*. Proceedings U. S. National Museum. 40(1824): 369-376 + plates.

This group of fresh-water sunfishes has been variously divided by different authors based mainly on the presence or absence of a supplemental maxillary and the shape of the lower pharyngeal bones, the character of their teeth, the length and shape of the pectoral fin and the presence or absence of a red spot on the opercular flap.

The paper is essentially a taxonomic hassle with descriptions presented.

48. Bean, Tarleton H. 1884a. The Burbot - *Lata maculosa*. In: Goode, George Brown (Ed.). The Fishery Industry of the United States. U. S. Commission Fish and Fisheries. pp. 235-240.

This article gives the size, habitat, abundance, distribution, feeding habits, economic value and reproduction activities of the Burbot. In Lake Ontario the Burbot is known as the "Ling" and generally its average weight is two and a half pounds. In the region of the Great Lakes, the Burbot is considered worthless whereas in other parts of the world it is highly esteemed. It is stated that not much is known of the life history of the Burbot and this is exemplified by the fact that the author requested that anyone who has information on the Burbot to submit it to the Commissioner of Fisheries.

49. Bean, Tarleton H. 1884b. On the occurrence of the Branch Alewife in Certain Lakes of New York. In: Goode, George Brown (Ed.). The Fishery Industries of the United States, U. S. Commission of Fish and Fisheries Section III, Part S(177). pp. 588-593.

The article discusses the occurrence of the branch alewife in Lake Ontario, Cayuga and Seneca Lakes. The author attributes the presence of the alewife in Lake Ontario through accidental introduction of it when Shad was introduced into the lake. Also discussed are the movements of schools of alewife, enemies and fatalities, and the methods of capturing and utilizing the alewife.

50. Bean, Tarleton H. 1902. Food and game fishes of New York. 7th Annual Report, Forest, Fish and Game Commission, State of New York Assembly Documents. 25(63): 251-460.

This article is a compilation of food and game fishes numbering 149 species. The habitat of these fishes is in the drainage systems of New York State, much of which in some way communicates with Lake Ontario. These belong to 36 families of which the most important are the Catfish, Sucker, Minnow, Herring, Salmon, Pike, Mackerel, Sunfish and Weakfish families.

51. Beardslee, Clark S. 1944. Bonapartes' gull on the Niagara River and Weatern Lake Erie. The Wilson Bulletin. 56(1): 9-14.

A study was made on the group movements, dates of molting and variant plumage of Bonaparte's Gulls on the Niagara River and eastern Lake Erie from 1921 to 1943.

The adults arrive in late March and early April, leave during May, return in late July and August, and depart in September, October and November. The young of the previous year arrive in May, drift northward in late

May and early June and probably compose a large portion of the great November and December flocks. Juveniles are rare in the fall. Rates of prenuptial and postnuptial molts are given. The band-headed plumage of adults and immature birds is described.

52. Beardslee, Clark S. and H. D. Mitchell. 1965. Birds of the Niagara Frontier Region. An annotated check list. Bulletin of the Buffalo Society of Natural Sciences. Vol. 22. 478 p.

This check list of birds in the Niagara Frontier Region includes information on waterfowl, gulls, shorebirds from the Niagara River and nearby Lake Ontario. Information includes general information on the birds, observation dates and exact areas. Information on seasonal status, nomenclature, classification and relation to climate is included.

Beeton, Alfred M. - See: John E. Gannon, No. 177.

53. Beeton, Alfred M. 1965. Eutrophication of the St. Lawrence Great Lakes. Limnol. Oceanogr. 10(2): 240-254.

Lakes Huron, Michigan and Superior are classified as oligotrophic lakes on the basis of their biological, chemical and physical characteristics. Lake Ontario, although rich in nutrients, is morphometrically oligotrophic or mesotrophic because of its large area of deep water. Lake Erie, the most productive of the lakes and the shallowest, is eutrophic. Several changes commonly associated with eutrophication in small lakes have been observed in the Great Lakes. These changes apparently reflect accelerated eutrophication in the Great Lakes due to man's activity.

54. Beeton, Alfred M. 1966. Indices of Great Lakes eutrophication. Univ. Michigan, Great Lakes Research Division. Proceedings 9th Conference Great Lakes Research. 15: 1-8.

The concept of eutrophication is discussed in terms of its relationship to aging of lakes, environmental changes and pollution. Various changes in physical, chemical and biological characteristics of the Great Lakes are reviewed. Increases in nitrogen, phosphorus, changes in species composition and increases in the abundance of plankton, decreases in the dissolved oxygen content of bottom waters, changes in fish populations in Lake Erie, the replacement of *Bosima coregoni* by *B. longirostris*, and extensive growths of *Cladophora* are acceptable indices of eutrophication and have been observed in other lakes.

55. Beeton, Alfred M. 1968. Report on the environment and biota of the Niagara River above the American Falls. American Falls International Board, International Joint Commission, Washington, D. C. (Unpublished). 11 p.

This paper presents a study of the nature and extent of measures necessary to preserve and enhance the scenic beauty of the American section of the Niagara Falls. This area will be dewatered for about 6 months in the summer and fall of 1969 and the possible effects of this action on the ecology of the area were to be studied. It was noted that the area is inhabitated *Cladophora*. The emerald shiner was abundant along shore. Midge larvae, a crustacean (*Gammarus sp.*)and free living tuberellearians were found. Snails (*Gyraulus* and *Physa*), caddis, fly cases and leaches were found at several places. Certain species of larger aquatic plants (*Myriophyllum verballatum Patamogeton angustifoluis*) were found growing in sheltered areas below islands and typical pond animals such as water striders,dragon flies, beetles and snails were abundant. It was concluded the aquatic habitats and their biota will be eliminated when the area is dewatered but they will reestablish themselves in a relatively short time after the cofferdam is removed. The major concern was for the terrestrial plants such as willows in the area. It was recommended that if these show wilting, they should be given additional water.

56. Beeton, Alfred M. 1969. Changes in the environment and biota of the Great Lakes. In: Eutrophication: causes, consequences, correctives. Academy of National Science, Washington, D. C. pp. 150-187.

Included in this article is a section on the biological changes in Lake Ontario. It contaims information on the changes that have occurred in the plankton and the commercial fishery.

57. Beeton, Alfred M. 1970a. Statement on pollution and eutrophication of the Great Lakes. Univ. of Wisconsin, Center for Great Lakes Studies. Report No. 11. 35 p.

The St. Lawrence Great Lakes constitute one of the most important resources of North America because of their size and generally excellent quality of their waters. The multiple use of the Lakes has resulted in a number of serious problems for which we are attempting to find solutions. Some problems have been: the collapse of certain fisheries due to the invasion and population explosion of the alewife, a marine fish, the periodic die offs of which have made many beaches unstable and worked a great economic hardship on the tourist industry; pollution which has resulted in accelerated eutrophication of the lakes; and regulation of water levels to meet the needs of shipping, hydroelectric power and shoreline property owners.

58. Beeton, Alfred M. 1970b. Statement on pollution and eutrophication of the Great Lakes to Sub-committee on Air and Water Pollution of the Committee of Public Works U. S. Senate. Center for Great Lakes Studies, Univ. Wisconsin, Milwaukee. 39 p.

Included in this report is a review and general statement on the eutrophication and changes in all the Great Lakes. Concerning Lake Ontario is the discussion of the changes in the planktonic algae and commercial fisheries both in species and quantity changes and some reasons for the change-graphs are included. A discussion of the eutrophication problem and its significance in the accelerated changes in the Great Lakes the pollution problem is summarized. The phosphorus sources of Lake Ontario are included in a chart and its specific effects on biota of the Lake. Some remedial measures and specific recommendations of the problems concerning the Great Lakes are made.

59. Beeton, Alfred M.and David C. Chandler. 1963. The St. Lawrence Great Lakes. In: Frey, D. G. (Ed.). Limnology in North America. The Univ. Wisconsin Press, Madison, Wisconsin. pp. 535-558.

This paper includes a general overview of some of the biological, chemical and physical characteristics of the St. Lawrence Great Lakes. A discussion of the characteristic organisms of all the Great Lakes including Lake Ontario is included. Changes in relative species composition and quantity is noted. A history of Great Lakes research including biology is discussed along with the agencies involved.

60. Belknap, John B. 1955. The expanding range of the ring-billed gull. The Auk. 5(3): 63-64.

The ring-billed gull (*Lours delevarensis*) is an inland species, its home originally being the prairie regions of the United States and Canada. However, the breeding area has been expanding and by 1927 it had secured a toehold in northeastern Lake Ontario. It is believed the first breeding record of this species was on Gull Island off Hevderson Harbor, Lake Ontario. This population increased to 45,000 pairs in 1955.

Bell, James B. - See: Bernard J. Dutka, No. 138, 139, 140.

Bell, James B. - See: H. VanOtterloo, No. 572.

61. Bellis, V. J. and D. A. McLarty. 1967. Ecology of *Cladophora glomerata (L.) Kutz.* in Southern Ontario. Journal Phycology. 3(2): 57-63.

Cladophora glomerata (L.) Kutz. was identified as the most conspicuous alga in streams and along the shores of the lower Great Lakes. This species was the plant most frequently associated with nuisance accumulations of algae along beaches in Lakes Erie and Ontario. Included in the paper is an ecological and morphological discussion of *Cladophora glomerata*.

62. Bennett, Elizabeth A. 1969a. Bacteriology of the Great Lakes. In: Anderson, D. V. (Ed.). The Great Lakes as an Environment. Great Lakes Institute, Univ. Toronto. Appendix 6(4): 87-107.

This paper presents some information on bacteriology of the Great Lakes. Each lake is considered in terms of "Indicator" bacteria, which are bacteria of public health significance, pathogenic bacteria, indigenous bacteria and types of heterotrophic bacteria in water and sediments. (Canada Centre for Inland Waters).

63. Bennett, Elizabeth A. 1969b. Investigations of daily variations in chemical, bacteriological and biological parameters at two Lake Ontario locations near Toronto. Part II - Bacteriology. Proceedings 12th Conference Great Lakes Research. pp. 21-38.

Daily variations in densities of coliforms, fecal coliforms, enterococci and total plate count were investigated using samples collected five days a week from Toronto Harbour (TH-1) and the raw water intake of the R. C. Harris Filtration Plant (LO-6). Weekly depth and sediment samples were collected to complement information from daily samplings. Bacterial populations at the two stations were log-normal distributed and deviations occurred in response to changing meteorological conditions. At TH-1, increases in numbers of bacteria within 24 to 48 hours following rainfall. At LO-6, increases were generally associated with epilimnetic water and off-shore wind. Densities of total coliforms and enterococci exhibited seasonal variations, the numbers of coliforms being the highest in summer and lowest in winter, while those of enterococci were the reverse.

The genus *Aeromonas*, non-coliforms, comprised a significant proportion of the sheen and non-sheen colonies from m-Endo coliform plates. Among total plate count isolates increase in the percent incidence of the genus *Acinetobacter* was associated with an increased level of coliforms. Change in the genetic composition of the bacterial flora at different water temperatures were observed. Heterotropic bacteria per gram dry weight of sediment fluctuated between 10^8 and 10^9 on Foot and Taylor agar and between 10^4 and 10^5 on MacConhey agar. Foot and Taylor isolates were chiefly *Alcaligenes*, *Bacillus* and *Acinetobacter*, while those from MacConhey agar were predominantly *Aeromonas* types.

64. Bentley, W. G. 1952. Present status of fisheries in New York waters of Lake Ontario. Research Council Ontario, Advisory Committee Fish and Wildlife. Rept. No. 3-6-52. Appendix "C-2". 1 p.

A short paper consolidating the present data concerning the commercial fish industry in Lake Ontario. Mentioned is the number of commercial fishing licenses given out, the type of fish being caught at the present time and the type of net being used by the commercial fishermen. (Univ. of Toronto Zoology Library).

Berg, C. O. - See: W. M. Harman, No. 231.

65. Best, T. F. 1912. Lake Ontario and Bay of Quinte. Ontario Game and Fish Dept. 5th Annual Report (1911): 39-50.

The paper reports a summary of the findings of the overseerers in each of their districts. It was noted that most fishermen had obeyed the fishing regulations during the year. The inspectors mentioned an increasing carp problem, having had several complaints that the perch fishing is being spoiled by the carp eating up all the spawn. (Univ. of Toronto Zoology Library).

Bidgood, B. - See: H. R. McCrimmon, No. 351.

66. Bigelow, N. K. 1922. Representative *Cladocera* of Southwestern Ontario. Univ. Toronto Studies, Biological Series Nos. 17-21: 111-128.

During the past two years the author of this paper made a special study of the *Cladocera* in various parts of the Province of Ontario. The occurrence of forty-nine species of *Cladocera* is recorded according to the classification and arrangement based on Birge (1918). Samples were studied from Georgian Bay, Port Sydney, Toronto, Lake Ontario, Bond Lake, Wilcox Lake, Lake Erie and Point Pelee. Drawings used to illustrate the papers were made from specimens collected in the various localities mentioned above.

Bishop, S. C. - See: J. R. Greeley, No. 216.

Blahaslee, C. L. - See: Imogene Robertson, No. 488.

67. Blain, A. W. 1904. Holboell's grebe at Niagara Falls. The Auk. 21: 276-277.

While on a trip to Niagara Falls (Sept. 20, 1903), the author found a fine specimen of Holboell's Grebe (*Colymbus halboelli*) on the Canadian side just opposite the American Falls. It had been shot by the proprietor of a curio shop while it was swimming out in the rapids.

68. Blair, A. A. 1938. Scales of Lake Ontario salmon indicate a landlocked form. Copeia. 4: 206.

Scale analysis shows that the difference between the ouananiche salmon from Lake St. John and the Lake Ontario salmon is not significant but the difference between Lake Ontario salmon and the sea salmon from Miramichi Bay is significant.

69. Bligh, G. E. 1971. Environmental factors affecting the utilization of Great Lakes fish as human food. Limnos. 4(1): 13-18.

Factors affecting the utilization of Great Lakes fish as human food are discussed in this report. Included were changes in species quantity and quality due to increased rate of eutrophication. Contamination of fish from bacteria and industrial wastes is included. Concerning pesticides and mercury, data is in tables. In Lake Ontario, fish approaching or exceeding allowable limits of pesticides are whitefish lake herring and white perch. Average mercury levels of some fish in Lake Ontario is included with the breakdown into basins and areas as to area analyzed. Lake Ontario appears to be suffering most from mercury pollution with only smelt, lake herring and whitefish running consistently below the 0.5 ppm limit.

Brinkhurst, Ralph O. - See: A. G. Appleby, No. 35.

Brinkhurst, Ralph O. - See: M. Waure, No. 579.

70. Brinkhurst, Ralph O. 1964. Studies on the North American aquatic oligochaeta I. *Naididae* and *Opistocystidae*. Proceedings Academy Natural Sciences, Philadelphia, Pennsylvania. 116: 195-230.

The occurrence and distribution of North American aquatic oligochaeta has been reviewed from a study of museum collections at the American Museum of Natural History, New York; the Academy of Natural Science, Philadelphia; and the United States National Museum, Washington, as well as collections loaned by limnologists from all over North America and some material collected by the author. Most of the *Naididae* recorded in North American literature have been found, together with some not yet previously recorded, and these are described and figured. Keys to the species are also erected. The geophysical distribution of the species found is briefly discussed.

71. Brinkhurst, Ralph O. 1969a. The fauna of pollution. In: Anderson, D. V. (Ed.). The Great Lakes as an environment. Great Lakes Institute, Univ. Toronto. Report PR 39. pp. 97-112.

The paper deals with the different types of fauna found in polluted waters from plankton to fish. Discussed is the concept of an ecosystem of a lake and the changes which occur when the lake undergoes eutrophication through the addition of sewage, meat packing wastes, dairy and cannery wastes. An emphasis is placed on the changes in the benthic community under enrichment conditions. The article generally covers the Great Lakes with a specific remark on the Bay of Qunite and Toronto Harbor. (Canada Centre for Inland Waters).

72. Brinkhurst, Ralph O. 1969b. Changes in the benthos of Lakes Erie and Ontario. In: Sweeney, R. A. (Ed.). Proceedings of the Conference on Changes in the Biota of Lakes Erie and Ontario. Bulletin of the Buffalo Society of Natural Sciences. 25(1): 45-65.

Recently a few pieces of evidence have come to light which suggest that a lake is as productive as its watershed and nutrient input. It is suggested that if we control the input of nutrients we can control eutrophication and perhaps reverse the process.

Brinkhurst urges examining regions of the Great Lakes and identifying the areas that may be considered undergoing accelerated eutrophication.

The benthic organisms may be the best indicators of change. These organisms, however, are very poorly known in terms of both systematics and ecology. The increased interest in pollution detection using biological parameters has led to a greater awareness of the need for study of benthic organisms.

The paper contains a comparative review of the benthic investigations in both lakes Erie and Ontario. The discussion includes the following organisms: oligochaetes, sphaeriids, mollusks and chironomids. These organisms can be used as indicators on the basis of their associations and population densities in areas of known pollution. These relationships should at least establish some ground rules for the future investigations of the benthic communities and serve as a yearstick against which later changes may be measured.

73. Brinkhurst, Ralph O. 1970. Distribution and abundance of tubificid (Olegochaeta) species in Toronto Harbour, Lake Ontario. Journal Fish. Research Board of Canada. 27: 1961-1969.

Toronto Harbour, Lake Ontario, receives a considerable load of raw, partially treated and treated sewage, as well as other organic and inorganic pollutants from the Don River, the storm water overflows of the City of Toronto, large and small ships, summer homes on the Toronto islands and surrounding industries. A detailed study of the relation between the worm population and certain constituents of the sediment is currently being undertaken, following the pilot study of Brinkhurst and Chua (1969). In this paper the distribution and abundance of species present and some data on dry weight determinations are discussed. One set of samples was taken ever 4 hr. for a period of 20 hr. to check for diurnal changes in vertical distribution of the worms.

74. Brinkhurst, Ralph O. and Kian E. Chua. 1969. Preliminary investigation of the exploitation of some potential nutritional resources by three sympatric tubificid oligochaetes. Journal Fish. Research Board Canada. 26: 2659-2668.

Eight heterotrophic aerobic bacteria were identified in samples from Toronto Harbour. The three tubificid species present seem to ingest most if not all of these, but different species survive passage through the gut. One of the three worm species absorbs amino acid from solution in the absence of bacteria in the gut. It is suggested that the results indicate differences in the utilization of the potential nitritional resources by the worms, which may be reflected in the ability of three unspecialized sediment feeders to coexist in the same microhabitat.

75. Brinkhurst, Ralph O., Kian E. Chua and E. Batoosingh. 1969. Modifications in sampling procedures as applied to studies on the bacteria and tubificid oligochaetes inhabiting aquatic sediments. Journal Fish. Research Board Canada. 26: 2581-2593.

The KB corer has many advantages over other bottom-sampling devices including some other coring tubes. It may be used to obtain reliable estimates of the standing stock of benthic invertebrates inhabiting soft sediments and of their spatial distribution in lakes and rivers. It may be used for studies of the vertical distribution of animals and bacteria, and could be used for a wide variety of studies on sediments. Multiple-unit versions have been built and operated, thus, overcoming the size limitation imposed by the basic design. This paper communicated some results obtained using this sampler.

76. Brinkhurst, Ralph O, A. L. Hamilton and H. B. Herrington. 1968. Components of the bottom fauna of the St. Lawrence, Great Lakes. Great Lakes Institute. Univ. Toronto, PR - 33. 50 p.

During synoptic cruises through Georgian Bay, Lake Ontario and Lake Erie, patterns of 60-80 stations were sampled by the crew of the Porte Dauphine, the research vessel of the Great Lakes Institute, University of Toronto. The bottom samples were used to determine the distributions of the major components of the bottom fauna. Three groups, the oligochaeta, sphaeriidae and chironomidae were studied extensively. The identity of the species found and their distribution in the lakes is discussed.

77. Brisbin, Angus, et.al. 1911. Lake Ontario and Bay of Quinte. Ontario Game and Fisheries Dept. 4th Annual Rept. pp. 40-49. 2 plates.

These reports are summaries given by overseers of the areas along Lake Ontario and Bay of Quinte. Commercial fish and angling catches are discussed along with illegal activities in each of their districts concerning fishing. (Univ. of Toronto Zoology Library).

78. Britten, B. T. 1970. Observations on the ecology of the American Niagara Falls. Report for the New York State Senate. 16 p. (Unpublished).

The dewatering of the American Niagara Falls in 1969 provided an opportunity to study its biology. Collection and identification was made on organisms living among the talus and within 300 ft. of the crest line above the falls and determinations of the estimated ecological conditions within the falls area were made. The collections produced a limited number of animal species generally represented by many individuals. Collected were mollusks, crustaceans, fish, insects and annelids. The plants of the area included algae, mosses and vascular plants. The algae *Cladophora* predominated the flora of the area.

Brown, Dugald E. A. - See: Carl L. Hubbs, No. 261.

Bruce, Allan - See: Bernard J. Dutka, No. 139, 140.

79. Bruce, Allan, Arnold Jurkovic and Bernard J. Dutka. 1967. A bacteriological study of the international section of the St. Lawrence River, conducted for the advisory board on water pollution, International Joint Commission. Dept. of National Health and Welfare, Division of Public Health Engineering, Kingston, Ontario. Manuscript Rept. No. 67-18. 41 p.

The present report records and summarizes the bacteriological data obtained from the May 5 to September 14, 1967 study of the St. Lawrence River.

The data show a progressive downstream increase in coliform, fecal coliform, fecal streptococcus and 20°C and 35°C standard plate counts. The majority of the northern stations (Canadian) were more polluted than the southernmost (U.S.A.) stations. Data also indicates that there is no obvious cross-boundary drift of pollution. (Rochester - EPA).

80. Budd, J. C., R. G. Ferguson and W. J. Christie. 1955. Lamprey scar counts from Canadian waters of the Great Lakes. Great Lakes Research Commission, Toronto, Ontario. Annual Rpet. for the Year 1954. Appendix. 3: 1-9.

The lamprey scar counts as reported for 1953 were extended in 1954 to include Lake Superior, Lake Erie and Lake Ontario. The counts were made by means of a questionnaire mailed each month to all commercial fishermen on the four lakes. These fishermen were asked to count both fresh and healed lamprey scars on their catches of trout and whitefish taken on a single day each month. In Lake Ontario, total scarring (both fresh and healed scars) is 11.6%, slightly more than double that found in Lake Huron and about three times greater than for Lake Superior. (Univ. of Toronto Zoology Library).

81. Budden, Frederick, R. 1953. Where are Lake Ontario's whitefish? Can. Fisherman. 40(5): 25.

The last really good catch of whitefish in Lake Ontario occurred around 1942 as illustrated by the fact that the fishing fleet out of Port Hope, Ontario has dwindled to two boats. This article contains an interview with some of the fishermen affected and a brief discussion of some aspects of the whitefish fishery. (Univ. of Toronto Main Library).

82. Burdick, G. E. 1940. A biological survey of the Lake Ontario watershed. Studies on the invertebrate fish food in certain lakes, bays, streams and ponds of the Lake Ontario watershed. NYS Conservation Dept. Supplemental to the 29th Annual Rept. for 1939. pp. 147-166.

Studies of the fish food (exclusive of plankton) of the Lake Ontario watershed dealt primarily with the areas that sustain the greatest intensity of fishing. One hundred eighty-seven collections will serve as a basis for calculation of the quantitative data and ecological notes on the mollusca. Stomach analyses of fish were undertaken in some of the areas that were studied. Pollution studies were made in some of the areas also. Graphs to show quantity of food, type of bottom and dpeth for each dredge line in several areas accompanied by outline maps to show the location of each line are included.

83. Burkholden, P. R. and Willis L. Tressler. 1932. Plankton studies in some northern New York waters. NYS Conservation Dept. Supplemental to 21st Annual Rept. for 1931., Biological Survey. 6: 222-251.

As part of the biological survey carried on in the summer of 1931, plankton studies were made in several bays of eastern Lake Ontario and the St. Lawrence River and certain lakes whose waters flow into the latter. Plankton collections were made from four bays in Lake Ontario, two large lakes and from the St. Lawrence River. In each of these lakes and bays from one to ten stations were selected for monthly observations in June, July, August 1931. At each station, quantitative and qualitative determinations of the various kinds of plankton organisms were made.

84. Cain, R. F. 1930. *Pomoxis annularis* in Ontario. Can. Field Naturalist. 44(6): 149.

Contains a brief note on the occurrence of *Pomoxis annularis* in the Grand River at Dunville, Ontario and from Lake Ontario in Burlington Bay.

85. Cairo, A. M., R. Yalkovsky and D. T. Meloon, Jr. 1971. Bacterial indicators of water pollution in the upper Niagara River. Abstract of paper presented at the 14th Conference Great Lakes Research, Toronto, April 19-21, 1971. pp. 53-54.

Water samples taken from the upper Niagara River between Lake Erie and Grand Island, and in the Black Rock Canal were examined for bacteriological indicators of water pollution. Bacteriological parameters used were as follows: the membrane filter technique on Eosin Methylene Blue agar for enumeration of coliforms, the elevated temperature technique for fecal coliforms and the membrane filter technique incubated on Streptococcus agar for fecal streptococci differentiation.

86. Canada Centre for Inland Waters. 1968a. Lake Ontario Limnological Report No. 1. Canadian Oceanographic Data Centre, Burlington, Ontario. 85 p.

This report is one on a series containing chemical, physical and bacteriological data from the waters of Lake Ontario. Biological parameters consisted of coliforms and fecal coliform counts.

Bacteriological data was obtained on one lake-wide cruise from April 30 to May 3, which consisted of 77 sampling stations.

87. Canada Centre for Inland Waters. 1968b. Lake Ontario Limnological Report No. 3. Canadian Oceanographic Data Centre, Burlington, Ontario. 85 p.

This report is one of a series containing chemical, physical and bacteriological data from the waters of Lake Ontario. Biological parameters consisted to coliform and fecal coliform counts.

Bacteriological data was collected on two lake-wide cruises. The first was October 5-9, 1956 and consisted of 82 sampling stations. The second cruise was from November 17-22, 1968 and consisted of 45 sampling stations.

88. Canada Centre for Inland Waters. 1969a. Lake Ontario Limnological Data Report No. 1, 1966. Canadian Oceanographic Data Centre, Burlington, Ontario. 40 p.

The report is one of a series listing chemical, physical and bacteriological data for waters of Lake Ontario observed by Canadian government agencies.

The report contains bacteriological sample data obtained from two cruises, May 31-June 5 and June 6-10, 1966, with sampling stations which covered the entire lake.

89. Canada Centre for Inland Waters. 1969b. Lake Ontario Limnological Data Report No. 3, 1966. Canadian Oceanographic Data Centre, Burlington, Ontario. 88 p.

The report is one of a series listing chemical, physical and bacteriological data for waters of Lake Ontario observed by Canadian government agencies.

The report contains bacteriological sample data from a cruise on Lake Ontario June 20-26, 1966. The sampling stations covered the entire lake.

90. Canada Centre for Inland Waters. 1969c. Lake Ontario Limnological Data Report No. 4, 1966. Canadian Oceanographic Data Centre, Burlington, Ontario. 113 p.

The report is one of a series listing chemical, physical and bacteriological data for waters of Lake Ontario observed by Canadian government agencies.

The report contains bacteriological sample data obtained from a cruise on Lake Ontario June 26-31, 1966. The sampling stations covered the southern side of the lake.

91. Canada Centre for Inland Waters. 1969d. Lake Ontario Limnological Data Report No. 5, 1966. Canadian Oceanographic Data Centre, Burlington, Ontario. 125 p.

The report is one of a series listing chemical, physical and bacteriological data for waters of Lake Ontario observed by Canadian government agencies.

The report contains bacteriological sample data obtained from a cruise on Lake Ontario 4-10, with sampling stations which covered the whole lake.

92. Canada Centre for Inland Waters. 1969e. Lake Ontario Limnological Data Report No. 6, 1966. Canadian Oceanographic Data Centre, Burlington, Ontario. 116 p.

The report is one of a series listing chemical, physical and bacteriological data for waters of Lake Ontario observed by Canadian government agencies.

The report contains bacteriological sample data obtained on two cruises of Lake Ontario. The first cruise extended from July 11-15, 1966 and consisted of 75 sampling locations situated over the entire lake except for the far eastern end. The second cruise was made from July 19-24, 1966 and 88 sampling stations were established over the entire lake.

93. Canada Centre for Inland Waters. 1969f. Limnological Data Report No. 7, Lake Ontario, 1966. (Cruise 66-9 July 26-29, Cruise 66-10 August 2-7). Canadian Oceanographic Data Centre, Burlington, Ontario. 113 p.

This report is one of a series listing chemical, physical and bacteriological data for waters of Lake Ontario observed by Canadian government agencies.

This report contains bacteriological sample data on two cruises (a) extended from July 26-29 and consisted of 19 sampling stations which were concentrated in two areas in the middle of Lake Ontario. The second cruise (b) consisted of 79 sampling stations taken over the entire lake with concentrations off the Niagara River.

94. Canada Centre for Inland Waters. 1969g. Lake Ontario Limnological Data Report No. 9, 1966. Canadian Oceanographic Data Centre, Burlington, Ontario. 119 p.

The report is one of a series listing chemical, physical and bacteriological data for waters of Lake Ontario observed by Canadian government agencies.

The report contains bacteriological sample data obtained on two lakewide cruises August 14-19, 1966 and August 29-September 2, 1966.

95. Canada Centre for Inland Waters. 1969h. Lake Ontario Limnological Data Report No. 10, 1966. Canadian Oceanographic Data Centre, Burlington, Ontario. 80 p.

The report is one of a series listing chemical, physical and bacteriological data for waters of Lake Ontario observed by Canadian government agencies.

The report contains bacteriological sample data obtained from two cruises, the first, September 6-11, 1966 and the second, September 12-16, 1966. The cruises covered the entire lake.

96. Canada Centre for Inland Waters. 1969i. Lake Ontario Limnological Data Report No. 11, 1966. Canadian Oceanographic Data Centre, Burlington, Ontario. 109 p.

The report is one of a series listing chemical, physical and bacteriological data for waters of Lake Ontario observed by Canadian government agencies.

The report contains biological sample data obtained from a cruise on Lake Ontario from September 20-24, 1966 which covered the southern and eastern portions of the Lake.

97. Canada Centre for Inland Waters. 1969j. Lake Ontario Limnological Data Report No. 12, 1966. Canadian Oceanographic Data Centre, Burlington, Ontario. 73 p.

The report is one of a series listing chemical, physical and bacteriological data for waters of Lake Ontario observed by Canadian government agencies.

The report contains bacteriological sample data obtained from two cruises, the first September 26-30, 1966 and the second September 30-October 3, 1966. The sampling stations covered the entire lake.

98. Canada Centre for Inland Waters. 1970a. Annual Report, 1969. Burlington, Ontario. pp. 6-10.

A number of important developments occurred at the Canada Centre for Inland Waters in 1969. Outlines of the various departments of the Centre are included in the report. These departments represent a spectrum of the research and activities occurring on the St. Lawrence Great Lakes. The Fisheries Research Board is of particular interest because of analysis of trace nutrient concentrations, nanaplankton and algal growth.

99. Canada Centre for Inland Waters. 1970b. Limnological Data Report No. 1, Lake Ontario, 1967. Canadian Oceanographic Data Centre, Burlington, Ontario. 212 p.

This report is one of a series listing chemical, physical and bacteriological data for waters of Lake Ontario observed by government of Canada agencies. The first cruise extended from June 12-17, 1967 and consisted of 73 sampling stations located over the entire lake. The second cruise extended from June 25-29, 1967 and consisted of 73 sampling stations situated over the entire lake. The third cruise consisted of 62 sampling stations situated over the entire lake.

100. Canada Centre for Inland Waters. 1970c. Lake Ontario Limnological Data Report No. 2, 1969. Canadian Oceanographic Data Centre, Burlington, Ontario. 179 p.

The report is one of a series listing chemical, physical and bacteriological data for waters of Lake Ontario observed by Canadian government agencies.

The report contains bacteriological sample data obtained on two lakewide cruises, July 25-30 in which 86 samples were taken and August 5-10 in which 80 samples were taken.

101. Canadian Centre for Inland Waters. 1970d. Lake Ontario Limnological Data Report No. 3, 1967. Canadian Oceanographic Data Centre, Burlington, Ontario. 232 p.

The report is one of a series listing chemical, physical and bacteriological data for waters of Lake Ontario observed by Canadian agencies.

The report contains bacteriological sample data obtained from three lakewide cruises on Lake Ontario from August 21-26, 1967 in which 78 samples were taken; September 5-8, 1967 in which 75 samples were taken and September 16-21, 1967 in which 91 samples were taken.

102. Canada Centre for Inland Waters. 1970e. Lake Ontario Limnological Data Report No. 4, 1967. Canadian Oceanographic Data Centre, Burlington, Ontario. 203 p.

This report is one of a series listing chemical, physical and bacteriological data for waters of Lake Ontario observed by Canadian government agencies.

The report contains bacteriological sample data obtained on three lakewide cruises, October 1-6, 1967 with 81 sampling stations; October 17-21, 1967 with 50 sampling stations and October 28-November 2 with 83 sampling stations.

103. Canada Fisheries Research Board. 1958. Technological Unit, London, Ontario. Canada Fish. Research Board Rept. for 1957-58. pp. 1630165.

The organizational period of the Unit consisted in establishing contacts with the freshwater fishing industry, finding out about its problems, furnishing technical advice and information and carrying out investigations when feasible.

In the Bay of Quinte, hoop nets were used for catching yellow perch, yellow pickerel and catfish. Gill nets were used in Lake Ontario proper and analyses were made on Lake Ontario alewife.

Chandler, D. C. - See: A. M. Beeton, No. 59.

104. Chandler, D. C. 1967. The St. Laurence Great Lakes. Great Lakes Research Division, Univ. Michigan. 1: 280-296.

Presented is a general discussion of biological, chemical and physical characteristics of all the Laurential Great Lakes. Concerning biology species lists of phytoplankton, zooplankton, benthos and fish are presented and discussed only in general terms as applying to all the Great Lakes in general. A discussion of the history of research organizations and programs is also included.

Christie, W. J. - See: J. C. Budd, No. 80.

Christie, W. J. - See: E. T. Garside, No. 178.

Christie, W. J. - See: W. B. Scott, No. 500.

105. Christie, William J. 1955. Report on Lake Ontario investigations. Annual Rept. Great Lakes Research Commission for the Year 1954, Section 2: Appendix 20: 1-14.

Between May 19 and September 18, 2441 whitefish were examined from 47 commercial catches taken in Eastern Lake Ontario. Data from the monthly reports of the fishermen are not yet complete. The sizes of the captured whitefish were measured and attempts were made at tagging them in the Bay of Quinte. This series of measurements was being used to determine the optimum mesh size for commercial fishermen. Tagging was used in an effort to determine the main migration routes of the whitefish in the Bay of Quinte.

A lake trout rehabilitation programme was instituted which involved stocking marked lake trout and the cooperation of commercial fishermen who observed the effects of lamprey on these stocked populations. (Univ. of Toronto Dept. Zoology).

106. Christie, William J. 1959. Ontario-New York Conference. Minutes of Meeting, April 9-10, 1959. Watertown, New York. Appendix A - Lake Ontario lake trout study, 1958 progress report. 5 p. + tables.

Included in the lake trout study is a discussion of plantings and recoveries with information on distribution, size, food and feeding, sex and state of maturity and lamprey scarring. (Univ. of Toronto Dept. Zoology).

107. Christie, William J. 1963. Effects of artificial propagation and the weather on recruitment in the Lake Ontario whitefish fishery. Journal Fish. Research Board Canada. 20(3): 597-646.

No significant relationship could be found between variations in the level of fry planting and ensuing variations in the level of catch in the long-term statistics of the Lake Ontario whitefish gill-net fishery. An alternate-year planting experiment, in which fry were planted in the even numbered years 1944 through 1954, similarly fail to show a detectable level of contribution of the hatchery fish to the fishery. The supported year-classes averaged larger than those not given hatchery support but this was judged coincidental because of a phasing with an alternate-year periodicity which characterized the catch statistics over the whole series examined, and was present six years prior to the start of the alternate year plantings.

A possible explanation for this periodicity was suggested by a significant correlation between air temperatures at times of spawning and hatching and the strengths of the produced year-classes. Cold Novembers followed by warm Aprils appeared to provide conditions associated with the production of larger year-classes, with the opposite combinations relating to the weaker broods.

The disappearance of lake trout and ciscoes from the commercial catch resulted in increased fishing pressure directed towards the capture of the whitefish. Increases in the efficiency and intensity of the fishing were observed during the period of study and were likely responsible for the reduction of the average age of the fish in the catch by almost one year, and resultant restriction of the annual catch to one year-class in recent years. Probably because most of the fish are currently caught before first spawning, a decline in spawning stock was almost continuous during the study period. The year to year fluctuations in the level of the catch increased both because of the reduced age and because of a greater variation in year-class strength. The year-classes produced in favorable years tended to decrease, down to quite low levels of stock. This gave a configuration similar to Richer's Type C reproduction curve, and which differed chiefly in that the limiting diagonal representing minimum reproduction fell below the replacement diagonal. It was suggested that the whitefish may require more than one spawning to achieve stock replacement. The present instability of the catch, and the potentially serious effect of any sustained break in the rythm of the climatic conditions suggest a condition of over-exploitation in this case.

108. Christie, William J. 1965. Fishing in the Bay of Quinte. Ontario Dept. Lands and Forests. Special Publication. 12 p.

Some aspects of the Bay of Quinte fishery resource and fisheries, both commercial and sport is presented here. The fish considered are almost exclusively commercial and consist of whitefish, bullheads, carp, eels and channel catfish. Exclusively sport fish consist of large and smallmouth bass, pike and maskinonge. Fish shared by both fisheries included percheral (walleye) smelt, perch, rock bass, sunfish and bluegills. Research is currently being done of these fisheries. The problem of the joint use of the yellow pickerel is under investigation. The yellow pickerel is the most important species for both the sport and commercial fisheries. A summary of the growth reproduction and ecology of the yellow pickerel is included. The white perch, a recent arrival to these waters, is now the most abundant fish and it is hoped to contribute to the sport fishery.

109. Christie, William J. 1968. Possible influences of fishing in the decline of Great Lakes fish stock. Proceedings 13th Conference Great Lakes Research. pp. 31-38.

The policy of liberalized fish management which has been in effect in the Great Lakes is assessed in the light of the seriously depreciated condition of many of the premium stocks, and with reference to recent information on the over-fishing problem. It is suggested that year class irregularity may result from excessive fishing pressure and that the rebound of a stock is not necessarily to be expected after a collapse. It is proposed that in situations where environmental change is not obviously involved, reproduction difficulties should be dealt with by means of restrictive environmental management.

The eastern Lake Ontario whitefish population is a good example of an over-exploited fish stock. The analysis of data on spawn deposition, average year class, strength and survival points to the fact that stock reduction is primarily due to the fishery in that area.

110. Christie, William, J. 1971. Fish species succession in Lake Ontario. Ontario Dept. Lands and Forests Glenora Fisheries Station, Picton, Ontario. Unnumbered. (Unpublished manuscript).

It has been many years since the publication of the last comprehensive description of the fish stocks of Lake Ontario. These years have unquestionably been most important in the history of the lake insofar as species change is concerned and this paper is offered primarily as a chronicle of these events. The succession of fish species is moreover presented against known changes, both biotic and abiotic, in the fish environment and to the extent that interpretation seemed allowable, possible relationship has been suggested. These are of course largely speculative, but they are offered as a background of hypotheses however fragile, to provide directions for future research.

General observations on successional changes, individual species change including most of the cold and warm water fish found in Lake Ontario are discussed. Statistics of fish catches by species since 1900 are included with differentiation between the eastern, western and central portion and Bay of Quinte in many instances. The names of the known fishes which have inhabited or still live in Lake Ontario are included. (Univ. of Toronto Dept. Zoology).

Chua, K. E. - See: R. O. Brinkhurst, No. 74, 75.

111. Claassen, P. W. and N. L. Cutler. 1928. Biological studies of polluted waters in the Oswego watershed. State of New York Conservation Dept., Supplemental to 17th Annual Rept. for 1927. A Biological Survey of the Oswego River System. pp. 133-139.

The object of this investigation was to determine the types of pollution present in the Oswego watershed. The exact location or source of each case of pollution; a study of the plants and animals which are found in polluted water and a study of the extent of the pollution present with a view of determining what effect the various types of wastes have upon fish and other fresh water organisms which normally inhabit clean waters. The effluents from sewage outfalls, milk wastes, paper and woolen mill wastes, canneries and sulphur and oil wastes all destroy the environment suitable for clean water organisms, such as most fish, mayflies, caddisfly and stonefly nymphs and favors the foul water organisms such as blue-green algae, sludge worms, rat tailed maggots and sewage fungus.

Clayton, D. - See: D. V. Anderson, No. 6.

112. Clark, Frank N. 1889. Whitefish distributed from Northville and Alpena stations. Bulletin U. S. Fish Commission for 1887. 7(4): 64.

The distribution of whitefish fry from the Northville and Alpena stations from March 25 to May 24, 1887 is given. A total of 3,000,000 fry were planted in Lake Ontario in the spring of 1887 from the two stations.

113. Clausen, R. T. 1940. A biological survey of the Lake Ontario watershed. VII. Aquatic vegetation of the Lake Ontario watershed. NYS Conservation Dept, Supplemental to 29th Annual Rept. for 1939, Biological Survey. pp. 167-187.

A survey was made of the larger aquatic vegetation in 58 bodies of water in the Lake Ontario watershed. These areas may be classified as bays, 14; mouths of streams, 12; natural ponds, 20; and artificial ponds, 12. The bays were of two types, those open to Lake Ontario and those either completely or partially closed. There was a marked variation in the amount of vegetation in the bays surveyed. This seemed correlated chiefly with the degree of pollution and the degree of outflow into Lake Ontario. Most of the natural ponds examined were bog ponds. Although there was great variation in abundance and in number of species present, the general association in most of these was similar. The artificial ponds too displayed a general similarity, but there was less variety in the species represented. Many of the stream mouths supported a varied aquatic flora. The lower Salmon River, with 40 species, many of them abundant, was particularly rich in plants.

In the course of the survey of the larger aquatic plants of the watershed, there were recorded 119 species of vascular plants, 5 species of bryophytes and 7 species of Characeae. In addition, several other species, not seen in the field in the 1939 season, were noted from the watershed as a result of the study of earlier herbarium specimens.

114. Clemens, W. A. 1921. Some results of a study of the herring of Lake Erie. Can. Fisherman. 8(4): 101.

Contains extracts taken from an illustrated lecture. Only a few specimens of the Lake Ontario herring were taken from Lake Erie which agreed with the descriptions and measurements given for the shallow water herring of Lake Ontario. (Univ. of Toronto Main Library).

115. Cobb, John N. 1898. Fisheries of Lake Ontario in 1897. 3rd Annual Rept. of the Commissioners of Fisheries, Game and Forests of the State of New York. New York Assembly Documents. 24(74): 205-221.

Contains the results of an investigation of the fisheries of Lake Ontario for the year 1897. Presented in tabular form is the following information: the men, vessels, boats, apparatus and shore property per county employed in the fisheries of Lake Ontario in 1897; the species and yield per county; and the comparative yields in 1880, 1885, 1890, 1893 and 1897.

116. Cobb, John N. 1900. The commercial fisheries of Lake Erie, Lake Ontario and the Niagara and St. Lawrence Rivers. New York Commission Fish, Game and Forests, 5th Annual Report. pp. 189-239.

The comparative yield (in pounds) of the fisheries of Lake Ontario in 1880, 1885, 1890, 1893, 1897 and 1899 is given. Presented in tabular form is the following information: a complete breakdown by county, apparatus and species of the yield of the fisheries in 1899; a table showing per county the men, boats, apparatus and shore property employed in the fisheries of the Niagara River in 1899; and a table showing by county the apparatus and species of the yield of the fisheries of the Niagara River in 1899. Also included is a discussion on the imports of Canadian fish in 1899.

117. Cole, Charles F. 1965. Additional evidence for separation of *Etheostoma olmstedi* Storer from *Etheostoma nigrum* Rafinesque. Copeia. No. 1: 8-13.

Specimens upon which the following information was based were taken from the Lake Ontario drainage of New York State. A revised discriminant function based on meristic data from 184 specimens of *Etheostoma nigrum* and 269 specimens of *Etheostoma olmstedi* from in and near the zone of overlap in New York substantiates Stone's 1947 conclusion that these are valid species. A 3-point character index achieves nearly the same level of species separation. Introgression of the interrupted infraorbital canal character of *E. nigrum* into populations of *E. olmstedi* is noted.

118. Collins, John D. 1885. Propagation of salmon in Salmon River, Oswego County, New York. Bulletin U. S. Fish Commission for 1885. 5: 287-288.

Brief article on the spawning efforts of *Salmo salar* in the Salmon River.

119. Conger, David, et.al. 1910. Lake Ontario and Bay of Quinte. Ontario Game and Fish Dept. 3rd Annual Rept. (1909). pp. 27-30.

Reported here are the summaries of the overseers of the areas along Canadian Lake Ontario and the Bay of Quinte. Commercial fishing, angling and illegal fishing are discussed. (Univ. of Toronto Zoology Library).

120. Couch, John H. 1922. The rate of growth of the whitefish *Coregonus albus* in Lake Erie. Univ. of Toronto Studies, Biological Series. Nos. 17-21. pp. 99-107.

The purpose of this investigation has been to obtain some definite information concerning the rate of growth of whitefish in Lake Erie. The specimens were procurred from points along the north shore of Lake Erie (Kingsville, Merlin, Ridgetown and Nanticoke). For purposes of comparison, eight speciment of whitefish were obtained from Port Credit on Lake Ontario and two from Hudson Bay at the Great Whale River. The Lake Erie and Lake Ontario fish have a very close resemblance and are considered to be from the species *C. clupeaformia*.

121. Covell, John, et.al. 1908. Lake Ontario and Bay of Quinte. Ontario, 1st Annual Rept. Game and Fish (1907). pp. 26-30.

This article consists of reports by overseers concerning the type and quality of fish caught as well as the type of fishing occurring in their districts during the year 1907. (Univ. of Toronto Zoology Library).

122. Coventry, A. F. 1922. Breeding habits of the landlocked sea lamprey (*Petromryzon marinus* var. *dorsatus* Wilder). Univ. of Toronto Studies, Biological Series No. 20. pp. 129-135. (Pubs. Ontario Fisheries Research Lab No. 9).

For many years it has been known locally that a lamprey occurs in Lake Ontario at least some miles east and west of Toronto. This lamprey has been confused to some extent with the silver lamprey (*Icthyomyzon bdellium* Jordan). No young have been recorded hitherto from the Toronto area, though there is a single metamorphosed specimen of 13.5 cm. taken in a swamp near Whitly in the university collection. A description of the life history of the sea lamprey in the Humber River just west of the city of Toronto in included.

123. Cowden, Sumner M. 1926. Proper methods of fish planting. New York Conservation Commission, 15th Annual Rept. for 1925. pp. 73-86.

Contains a discussion of fish planting with directions for planting various species. With reference to Lake Ontario, the common whitefish, *Coregonus clupeaformia*, was mentioned.

124. Creaser, Charles W. 1933. The parasitic lamprey of the lakes. Fisherman. 2(6): 3-4, 12.

The article discusses the physical characteristics of the lamprey, the differences between parasitic and non-parasitic forms, habitat, life cycle and its projected relation to the commercial fishermen. (Univ. of Toronto Zoology Library).

125. Crossman, E. J. 1968. Changes in the Canadian freshwater fish fauna. A Symposium on Introduction of Exotic Species, Ontario Dept. Lands and Forests. Research Rept. No. 82. pp. 1-20.

The entire freshwater fish fauna of Canada is a small one (186 species) compared with that of the United States or even that of the restricted area of the Great Lakes (U. S. and Canadian waters combined). Seven of the total of 27 families contain 72% of the species. Its present status has been the result of: increase in knowledge due to increase in collecting and inventory activity; immigration into the area by natural population expansion; intentional introduction of exotic species; and the loss of species through extirpation. Our fauna has lost at least three species by extirpation: the paddlefish, the blue walleye and the longjaw ciscoe.

126. Crossman, E. J. 1969. Changes in Great Lakes fish and fishing. In: Anderson, D. V. (Ed.). The Great Lakes as an Environment. Great Lakes Institute, Univ. of Toronto Report. PR 39: 150-175.

Presented in this paper is a good account of the history of the fishing on the Great Lakes, including Lake Ontario and many of its tributaries since the Indian times. Changes in the fish fauna, environment commercial fishing and exploitation of the Great Lakes is discussed. Some statistics concerning the fisheries in the Great Lakes is listed. Photographs and drawings of the different types of nets and equipment used by commercial fishermen is included. The future of the Great Lakes fisheries in terms of reclamation, introduction of exotics, stocking and better utilization of existing conditions is discussed. (Canada Centre for Inland Waters).

Cutler, N. L. - See: P. W. Claassen, No. 111.

127. Cutler, N. L. 1929. A biological survey of the Erie-Niagara System. IV. The biological investigations of pollution in the Erie-Niagara watershed. Supplemental to 18th Annual Rept. for 1928. NYS Conservation Dept. pp. 134-149.

The biological investigations of the conditions of pollution in the Erie-Niagara watershed were divided into: Lake Erie and Niagara River and streams. A description of the Niagara River and its pollution load. A list of indicators tolerant of sewage pollution has been compiled from those found in this area.

128. Czaika, Sharon C. and Andrew Robertson. 1968. Identification of the copepodids of the Great Lakes species of *Daiptomus* (Calanoida, Copepoda). Proceedings 11th Conference Great Lakes Research. pp. 39-60.

Six species from the calanoid copepod genus *Diaptomus* are found in the St. Lawrence Great Lakes. Each of these species possesses 12 post-embryonic life history stages, six naupliar followed by six copepodid with the final copepodid stage being the adult. There is currently no way to separate the nauplii or immature copepodids to species. The identification of the adults depends on secondary sex characters, but these are not developed on the immatures. At times even the identification of adult females is difficult because the taxonomic characteristics are quite similar for some of the species.

It is the purpose of this paper to held provide means for identifying the Great Lakes diaptomid copepodids. A method is presented that allows the separation of copepodids to species, stage and for the last three stages, sex. This method simplifies identification of the adult females by using clear cut traits for their separation.

The means for the identifications were developed by comparing the armature of all the appendages from each copepodid stage of each species. A number of differences in the armature have been noted among the different stages. Many of these vary only with stage but not with species or sex. A few differences in armature were found that varied within a given stage as to species but not as to sex. Several differences in armature were found within the last three stages that varies by sex but not by species. In addition to the changes allowing separation by stage, species and sex a key is included which summarizes the means of identifying Great Lakes calanoid copepodids to species, to stage and to sex.

129. Davis, Charles C. 1966. Plankton studies in the largest Great Lakes of the world with special reference to the St. Lawrence Great Lakes of North America. The Univ. of Michigan, Great Lakes Research Division. Publ. 14. pp. 1-36.

The purpose of the present communication is to survey critically and in detail the plankton investigations, exclusive of studies of primary productivity, that have been accomplished to date in the St. Lawrence Great Lakes of North America, to compare these results with those obtained from certain others among the largest lakes of the world, and to suggest fruitful avenues for further study.

130. Davis, Charles C. 1968. Plants in lakes Erie and Ontario and changes in their numbers and kinds. In: Sweeney, R. A. (Ed.). Proceedings of the Conference on Changes in the Biota of Lakes Erie and Ontario. Bulletin of the Buffalo Society of Natural Sciences. 25(1): 18-41.

This paper is essentially a literature survey on the changes in the vegetation of Lakes Erie and Ontario with sections on the causes of these changes. Lake Erie has been studied much more extensively than Lake Ontario, and therefore in comparison, Lake Ontario data is much deficient.

As far as the phytobenthos of Lakes Erie and Ontario goes, the investigation of non-parasitic fungi have amounted to nothing more than a few records of species. The macrobenthos have been studied more extensively but with little continuity. The studies dealing with periphyton are few and mostly dealing with taxonomy.

Phytoplankton studies on Lakes Erie and Ontario have been much more complete but still do not allow for any detailed reliable judgement concerning community changes over the years. Nevertheless, there have been tabulations of what is considered to be long range changes of dominant phytoplankters and relative quantities in cells/ml with the general trend from diatoms to replacement in parts by greens and blue-greens, with longer and more pronounced pulses.

This points to a need for extensive taxonomic surveys of benthic phytoplankton. In both lakes further quantitative studies on the phytoplankton are necessary along with the dynamics of primary productivity. Lake Ontario should be studied to a much greater degree because of little information on it as compared to Lake Erie. We do not have a clear quantitative conception of any of these matters and we badly need to develop clarity if we are to understand the ecosystems in our lakes.

131. Day, D. F. 1882. The plants of Buffalo and its vicinity. Bulletin Buffalo Society Natural Science. 290 p.

This collection is the result of research which began in 1863. It is the most comprehensive report of its time, which is concerned with the Buffalo area. It includes the areas of the Niagara River and a small portion of Lake Ontario on the eastern and western sides of the mouth of the Niagara River.

Deason, H. J. - See: R. Hile, No. 254.

Deason, H. J. - See: J. Van Oosten, No. 571.

132. Dechtiar, Alex. 1967. *Neochinorhynchus notimigoni* n. sp. (Acanthocephala: Neoechenorhynchidae) from golden shiner of Lake Ontario: Canadian Journal Zoology. 45(2): 155-159.

A new species of acanthocephalan, *Neoechinorhynchus notemigoni*, from the intestine of *Notemigonus crysoleucas* (Mithcell) is described. This is the 23rd species of the family Neoechinorhynchidae Van Cleave, 1919 and the 15th species of the genus *Neoechinorhynchus* Hamann, 1892, known from North American fish according to various authors. It is the sixth species of the genus *Neoechinorhynchus* which does not utilize catostomids as definitive hosts in North America.

133. Dence, Wilford A. 1952. Establishment of white perch. *Marona americana*, in Central New York. Copeia. No. 3. pp. 200-201.

A brief note on white perch which has not been found in Lake Ontario or the Finger Lakes or Oneida Lake but has now been established in Cross Lake and the Seneca River.

134. Dence, Wilford A. 1956. Concretions of the alewife, *Pomolobus pseudoharengus* (Wilson), at Onondaga Lake, New York. Copeia. No. 3. pp. 155-158.

The alewife represents one of the few marine fishes that has successfully adapted itself to freshwater environments. The species has been known to inhabit Lake Ontario in immense numbers for a least a century. Its occurrence in waters of Central New York, including Onondaga Lake, may be due to migration from Lake Ontario or to direct stocking but there is no factual basis for either theory.

A discussion of the concretions of the alewife, description, chemical analysis, deposition on beaches, etc. is discussed with comparisons on Lake Ontario and Onondaga Lake.

135. Department of National Health and Welfare, Public Health Engineering Division, Canada. 1967. Progress report to the International Lake Erie Water Pollution Board and International Lake Ontario - St. Lawrence River Water Pollution Board on Water Quality studies conducted during 1965-66. Presented at the Board Meetings, Cleveland, Ohio. Unnumbered.

Water quality studies were conducted during 1965-66 on the International section of the St. Lawrence River, the Bay of Quinte - eastern end of Lake Ontario and the deep water section of Lake Ontario. The biological parameters used were MF coliforms, MF *Enterococci*, MPN coliforms, MPN *Enterococci*, MPN fecal coliforms, standard plate count at 35°C and standard plate count at 20°C. In addition, identifications of the actual species of bacterial groups was carried out on isolates taken from samples collected during the summer survey.

Dickson, G. H. - See: R. W. Sheppard, No. 511, 512.

136. Dore, W. G. 1956. *Wolffia* in Canada. Canadian Field-Naturalist. 71(1): 10-16.

The water-meals of the genus *Wolffia*, the smallest of all flowering plants in the world are of relatively restricted occurrence in Canada. This paper deals primarily with their diagnostic characters, geographical distribution and occurrence and preparation of preserved specimens. Two species of *Wolffia* have been described occurring in Lake Ontario, *Wolffia columbiana* and *Wolffia punctata*. Examination of early records on these plants makes it difficult to decide whether or not the two species of *Wolffia* were original elements of the Lake Ontario flora.

Douglass, E. J. - See: Glen C. Leach, No. 327.

Duthie, H. C. - See: M. R. Sreenivasa, No. 537.

137. Duthie, H. C. and M. R. Sreenivasa. 1971. Evidence for the eutrophication of Lake Ontario from the sedimentary diatom succession. Abstract of paper presented at the 14th Conference Great Lakes Research, Toronto, April 19-21, 1971. pp. 119-120.

Seventy-three taxa of diatoms were identified from a sediment core taken from Lake Ontario. Quantitative analyses were subsequently made and the dominant forms noted.

Dutka, Bernard J. - See: Allan Bruce, No. 79.

Dutka, Bernard J. - See: A. S. Menon, No. 364.

Dutka, Bernard J. - See: J. M. Vanderpost, No. 568.

Dutka, Bernard J. - See: H. Van Otterloo, No. 572.

138. Dutka, Bernard J.and James B. Bell. 1967. The classification of coliform bacteria isolated from Lake Erie and Lake Ontario. Dept. of National Health and Welfare, Division of Public Health Engineering, Kingston, Ontario. Manuscript Rept. No. 67-21. 36 p. + tables.

A total of 1,479 representatives, typical "sheened" coliform colonies appearing on the filter membranes were isolated for pure culture study onto Bacto-MacConbey Agar. The present report concerns the biochemical classification and distribution patterns of these coliform strains in Lakes Erie and Ontario.

From the data presented, it may be concluded that:

1. There was a high degree of similarity in coliform biotype incidence in Lake Erie and Lake Ontario; however, on comparing 1966 biotype incidence data from Lake Ontario with that collected in 1967, a greater variation in biotype incidence was noted, than was observed between the 1967 studies of Lakes Ontario and Erie.

2. The low-density coliform flora of the off-shore Lake Ontario and Erie study areas, were characterized by a high incidence of *Enterobacter* biotypes, and a relatively low incidence of *Escherichia* biotypes and fecal coliform strains. This coliform biotype distribution pattern is considered to be typical of "remote" pollution originating from distant sources, and is probably of minimal public health significance.

3. There was a remarkable degree of uniformity in coliform biotype distribution patterns found at all sampling depths and all basins and sectors of both Lakes; no significant basin-to-basin and sector-to-sector trends in coliform biotype incidence were apparent.

4. The fidelity of a fecal coliform test applied to Lake Ontario and Erie waters as an estimate of *E. coli* type I densities may be expected to be unusually low because of the relatively high incidence of other EC (44.5°C) gas positive coliform biotypes, principally Irregular 22.

5. A typical slow-or non-lactose fermenting strains displayed a greater variation in their distribution patterns on both lakes than did typical lactose fermenting strains.

6. A typical slow-or non-lactose fermenting strains constituted 29.5% and 35.3% of the isolates from typical "sheened" coliform MF colonies collected from Lakes Ontario and Erie.

7. Only four enteropathogenic *E. coli* strains were isolated, two from each Lake; all were isolated from different areas in each Lake and from water samples with relatively low coliform MF counts. (Rochester-EPA).

139. Dutka, Bernard J., Allan Bruce, James Bell and Alan D. Tennant. 1966a. A bacteriological study of the St. Lawrence River and the Bay of Quinte, conducted for the advisory board on water pollution, International Joint Commission. Dept. of National Health and Welfare, Division of Public Health Engineering, Kingston, Ontario. Manuscript Rept. No. 67-2. Unnumbered.

A water quality study of the international section of the St. Lawrence River and the eastern near-shore portion of Lake Ontario as far west as Trenton, Ontario including the Bay of Quinte was conducted from August 16 to October 21, 1965 and May 15 to October 15, 1966.

During the 1965 preliminary study of the international section of the St. Lawrence River, a total of 311 water samples collected from 106 stations on 22 ranges were subjected to coliform density lists. In 1966, 3,535 individual bacteriological tests were conducted on 1,234 water samples collected from 103 sampling stations on 29 ranges.

A total of 1,783 bacteriological tests were conducted on 667 water samples collected from 53 stations of 14 ranges in the Bay of Quinte in 1966.

Two general trends can be seen from the St. Lawrence River coliform data. Most of the northern sample stations have higher coliform MF and MPN densities while the southern sampling stations have the lowest MF and MPN densities. Also, there were lower coliform densities upstream as compared with those recorded for the downstream sector.

There appeared to be a trend to higher coliform MF counts throughout the study area in May and again during the mid-July to Lake September period. (Rochester-EPA).

140. Dutka, Bernard J., Allan Bruce, James Bell and Wolfgang Winter. 1966b. Classification of coliform bacteria isolated from the St. Lawrence River and the Bay of Quinte. Dept. of NationalHealth and Welfare, Division of Public Health Engineering, Kingston, Ontario. Manuscript Rept. No. 67-14. 31 p.

A water quality study of the international section of the St. Lawrence River and eastern near-shore portion of Lake Ontario including the Bay of Quinte, was conducted from May 15 to October 15, 1966.

Bacteriological data obtained from 1,234 water samples from the St. Lawrence River and 667 water samples from the Bay of Quinte, were recorded and discussed in Manuscript Report 67-2. A total of 3,569 typical and atypical colonies appearing on Bacto-M-Endo MF preparations and cultures isolated from gas-positive Most Probable Number tests from water samples from selected sampling stations were isolated in pure culture for further study and classification. The present report concerns the identification of these cultures, the incidence of coliform and fecal coliform biotypes and enteropathogenic *Escherichia coli* Serotypes, in the various sectors of the study area.

When the coliform biotype distribution pattern for the St. Lawrence River study area is compared to that for the Bay of Quinte, only three major differences are evident:

1. *Enterobacter* biotypes are most predominant in the Bay of Quinte (53.1 as compared to 44.6 percent).

2. Irregular coliform biotypes are more common in the St. Lawrence River (17.4 as compared to 7.9 percent).

3. The Bay of Quinte had the greater incidence of gelatin liquifying strains (23.6 as compared to 15.2 percent). (Rochester-EPA).

141. Dutka, Bernard J., J. Popplow and J. Yurack. 1967. The isolation of *Salmonellae* from the Bay of Quinte and the St. Lawrence River. Dept. of National Health and Welfare, Division of Public Health Engineering, Kingston, Ontario. Manuscript Report No. 67-22. 15 p.

The purpose of this paper is to report the isolation of *Salmonellae* in waters studied which include the international section of the St. Lawrence River and the eastern near-shore portion of Lake Ontario as far west as Trenton, Ontario including the Bay of Quinte.

Coliform, fecal coliform, fecal *streptococci* and standard plate count densities were determined. Emphasis on a search for *Salmonellae* (pathogenic bacteria which represent proof of a public health hazard, when present) was also made. The data tended to support the belief that some degree of health hazard does exist in the waters studied. (Rochester-EPA).

142. Dutka, Bernard J., J. Popplow and J. Yurack. 1968. *Salmonellae* isolation from surface waters. Proceedings 11th Conference Great Lakes Research. pp. 531-537.

A search for *Salmonellae* was conducted during the summer of 1967 in the eastern near-shore sector of Lake Ontario between Kingston and Trenton, including the Bay of Quinte and in the International Section of the St. Lawrence River. Modified Moore gauze pads (swabs) were used for the collection of specimens from 16 water sampling stations in the study areas. The elevated-temperature technique of Spino (1966) was used, with minor modifications, for isolation of *Salmonellae*.

Of a total of 30 Moore swabs recovered after a seven-day exposure period, 14 (46.7%) yielded one or more *Salmonella* serotypes. A total of 195 *Salmonella* isolates were made from five of eleven Bay of Quinte sampling stations, from one of three St. Lawrence River stations and from a sampling point on the Kingston, Ontario waterfront. *Salmonellae* were isolated from waters with coliform and fecal coliform (membrane filter) counts as low as 33 and 6 per 100 ml, respectively; the frequency of *Salmonella* isolation increased, however, with increasing coliform and fecal coliform densities. *Salmonella* serotypes isolated were: *S. saint paul*, *S. tennessee*, *S. infantis*, *S. typhimurium*, *S. brandenburg and* Group C, non-motile. A Moore swab elevated temperature *Salmonella* isolation technique proved to be an efficient and practical method for the examination of suspected waters for *Salmonella* and the routine application of this procedure is advocated. (Rochester-EPA).

143. Dutka, Bernard J., John E. Reid, Allan Bruce and Wolfgang Winter. 1966. A bacteriological study of Lake Ontario and Lake Erie, conducted for the advisory board on water pollution, International Joint Commission. Dept. of National Health and Welfare, Division of Public Health Engineering, Kingston, Ontario. Manuscript Report No. 67-1. 101 p. + tables.

A water quality study of Lake Ontario was conducted by the Kingston Branch of the Public Health Engineering Division, Department of National Health and Welfare from June 6 to September 30, 1966.

Forty-seven monitor stations were established on Lake Ontario on a 12-mile triangular grid pattern. Five areas, Toronto, Niagara River, Rochester, Oswego and Black River were studied more intensely with sampling stations placed every 3 miles. Upon comparing bacterial densities from all the dpeths sampled, there appears to be little or no stratification of any statistical importance. (Rochester-EPA).

Dymond, John R. - See: W. J. K. Harkness, No. 229.

Dymond, John R. - See: A. G. Huntsman, No. 278.

144. Dymond, John R. 1927. Guide to the game fishes of Canada. Royal Ontario Museum of Zoology. No. 15. 18 p.

The purpose of the guide is to describe briefly the more important game species of Canada. It includes the relationship of each fish to other species, its standing as a game fish, distribution, habits and size to which it grows. (Univ. of Toronto Zoology Library).

145. Dymond, John R. 1928. Some factors affecting the production of lake trout (*Cristivomer namaycush*) in Lake Ontario. Univ. Toronto Studies, Biological Series No. 31. pp. 27-41. (Publications of the Ontario Fisheries Research Laboratory, No. 33).

The lake trout is one of the most important Canadian fresh-water fishes, ranking second only to whitefish in commercial importance. The Canadian waters of the Great Lakes produce 80 to 90 percent of the lake trout caught in Canada, about 15 percent of which is from Lake Ontario. Unlike either Lake Huron or Lake Superior, Lake Ontario has a smaller volume of water deep enough for lake trout thus accounting for its relatively small production of this species.

The food habits of lake trout were studied by examination of the stomach contents. Analysis showed that alewives are the favorite food of lake trout in Lake Ontario in the summer, with ciscoes ranking second in importance. Examination of the stomach contents of the ling indicate it is a serious competitor of the lake trout for food, it also preferring alewives to other species.

Lake trout in Lake Ontario spawn for the first time when about 6 pounds in weight. Those weighing from 6 to 10 pounds produce from 3000 to 10,000 eggs whereas those weighing from 20 to 25 pounds produce 15,000 to 18,000 eggs.

146. Dymond, John R. 1944. Spread of the smelt (*Osmerus Mordax*) in the Canadian waters of the Great Lakes. Can. Field Nat. 58: 12-14.

The paper discusses the introduction of the smelt in the Great Lakes. Includes when the first smelt was taken from each individual lake and the different uses of smelt.

147. Dymond, John R. 1955. The introduction of foreign fishes in Canada. Proceedings International Association Theoretical and Applied Limnologists. 12: 543-553.

Only four species of fishes not native to North America are known to have been introduced and to have survived in Canada and only two of these, the carp and the brown trout are of significance. In addition to species not native to North America, there are a number that have been transferred from one part of North America where they are native to parts of Canada in which they do not naturally occur. The rainbow trout is an outstanding example of species in this category, although there are several others whose success or failure is worthy of note.

Included in this report is a discussion of the following introduced fish: carp, goldfish, tench, brown trout, rainbow, atlantic salmon, pacific salmon, eastern brook trout, American smelt and the smallmouth bass. (Univ. of Toronto Zoology Library).

148. Dymond, John R. 1956. Artificial propagation in the management of Great Lakes fisheries. Transactions American Fisheries Society. 86: 384-392.

No positive evidence has been found to suggest that artificial propagation has ever been successful in significantly increasing the yield of a native species in the Great Lakes. Failure to find a correlation between the number of whitefish fry planted in the Bay of Quinte and the commercial production has been reported.

Several other instances concerning many species of fish are presented. The possible contribution of artificial propagation to the populations of Great Lakes fish has been investigated in three ways: by looking for correlations between the numbers of fry planted and the size of the commercial catch when the resulting individuals would have entered the fishery; through experiments in which marked lake trout fingerlings are planted and the number subsequently caught recorded; through experiments where fry are planted only in alternate years and the relative strengths of year classes in appropriate number of years later determined whether or not these last two experiments have been carried out long enough to yield decisive results. It is concluded that the size of a year class is determined by the conditions affecting hatching and survival rather than by size of spawning or released stock. (Canada Centre for Inland Waters).

149. Dymond, John R., J. L. Hart and A. L. Pritchard. 1929. The fishes of the Canadian waters of Lake Ontario. Univ. Toronto Studies, Biological Series No. 33. pp. 1-35. (Publications of the Ontario Fisheries Research Laboratory, No. 37).

This paper includes records of fishes from Lake Ontario and some of its tributaries streams based largely on collections made during the summers of 1927 and 1928. Records of occurrence, life history observations and habitat descriptions. Some interesting notes on the lake lamprey are included. Records of the release of Chinook salmon in the 1800's are included. An annotated list of species of fish taken in the Lake Ontario drainage is also included.

150. Eaton, E. H. 1901. Birds of Western New York. Proceedings of the Rochester Academy of Science. 4: 1-64.

This account describes in detail, the occurrences of those species of birds which inhabit the area of Western New York, known as the Alleghanian faunal area. This includes the area along the southern shore of Lake Ontario. The description includes relative abundance, migration, habitat, nesting dates and economic values in regards to the food of the different species.

151. Edmunds, M. C. 1874. Obstructions in the tributaries of Lake Champlain. U. S. Commission Fish and Fisheries, Rept. for 1872-1873. Part 2: 622-629.

An examination of the rivers of the Lake Champlain Valley and the south shore of Lake Ontario was made for the purpose of obtaining more accurate information as to the accessibility of certain interior waters to salmon, shad and other anadromous fishes passing from the ocean or the Great Lakes.

Black River and Chaumont were inspected but were found unsuitable for the introduction of salmon due to high and impassable dams. The Oswego River was also found unfit due to the canal. Big Sandy Creek and the Salmon River were found to be the best to commence the breeding of salmon artificially.

152. Embody, G. C. 1927. Stocking policy for the Genesee River system. Supplemental to 16th Annual Rept., NYS Conservation Dept., Biological Survey, Albany, New York. pp. 12-28.

It is desirable to have a well defined stocking policy for each drainage system of the state. One of the chief purposes of the present survey has been the development of such a policy for the Genesee River system. The following conditions should be considered in the formulation of such a policy: what kinds of fish are likely to find conditions suitable for reproduction, normal growth and the escape of enemies; and how many should be planted to utilize the water to its fullest extent.

153. Embody, G. C. 1929. A biological survey of the Erie-Niagara system. I. Stocking policy for the streams, lakes and ponds of the Erie-Niagara Watershed. Exclusive of Lake Erie. Supplemental to 18th Annual Rept., NYS Conservation Dept., Albany, New York. pp. 19-38.

In the present survey, the same methods have been used as heretofore described for the Genesee and Oswego watersheds. A discussion of the factors involved in the development of a stocking policy has already been given in the reports on the Genesee and Oswego surveys. A discussion focusing on the stocking recommendations for trout is included along with tables of trout conditions in streams, i.e. temperature relationships between air and water; and a planting table for trout streams. Following the discussion is a policy which was formulated for rainbow trout.

154. Evans, Kelly. 1912a. The effects of legislation on the whitefish fisheries. Final Rept. (1909-1911) Ontario Game and Fish Commission, Toronto. pp. 13-22.

When the elimination of the whitefish catch became apparent the most obvious remedies in hopes of checking it were in regulation of the fisheries. Discussed in this light is mention of regulation of equipment, methods of capture and size of net mesh, limitation of the numbers of nets and closing certain areas and seasons. Some statistics on pond and gill nets in use in Canadian Lake Ontario between 1892 and 1906 are included.

155. Evans, Kelly. 1912b. The effect on the whitefish fisheries of extensive hatchery operations. Ontario Game and Fish Commission, Toronto. Final Report (1909-1911). pp. 22-43.

As a remedy of the whitefish fisheries problem on the Great Lakes the author suggest the use of artificial propagation as a means of promoting large catches. Also discussed is some of the regulations and fees on the Great Lakes including Lake Ontario. Prohibition of export of whitefish and a Provincial Fish Agency also presented as means of remedy. (Univ. of Toronto Zoology Library).

Evermann, Barton W. - See: D. S. Jordan, No. 303.

156. Evermann, Barton W. 1902. List of species of fishes known to occur in the Great Lakes or their connecting waters. Bulletin U. S. Fish Commission. 21: 95-96.

A list of 152 species and subspecies of which 27 were solely found in the Great Lakes Basin. Did not note which species were found in what lake.

157. Evermann, Barton W. and William C. Kendall. 1902. Notes on the fishes of Lake Ontario. U. S. Commission Fish and Fisheries, Rept. for 1901. Part 27. pp. 209-216.

The present paper contains a list of approximately 73 species of fish found in Lake Ontario and the streams tributary to it, together with notes on their relative abundance and any structural peculiarities noticed.

158. Faber, Daniel J., E. G. Jermolajev and E. G. Kossiakina. 1966. A new copepod genus in the plankton of the Great Lakes. Limnology and Oceanography. 11(2): 301-303.

The genus *Eurytemora* (Copepoda, Calanoida) is common in the plankton of brackish waters around the work, but there are relatively few observations of it in the plankton of freshwater lakes. This report confirms and discusses the existence of this copepod in Lakes Ontario, Erie and Huron.

Fahy, W. E. - See: J. R. Westman, No. 584.

159 Faigenbaum, H. M. 1940. A biological survey of the Lake Ontario watershed. V. Chemical investigation of the Lake Ontario watershed. NYS Conservation Dept. Supplemental to 29th Annual Rept. for 1939, Biological Survey, Albany, New York. pp. 117-146.

Any substance or set of conditions which directly harms the fish or adversely alters its natural environment or depletes its food supply may be considered a pollutant. The physical and chemical determinations employed in this investigation are designed to determine the location, intensity and extent of the various types of pollution present.

In the table, "Chemical Analyses - Lakes and Ponds of the Lake Ontario Watershed" notes on the fish collected and remarks and stocking recommendations are given.

160. Farrell, M. A. 1932. Pollution studies. NYS Conservation Dept., Supplemental to 21st Annual Rept. for 1931. Biological Survey, Albany, New York. 6: 189-198.

The primary object of the study was to determine the stream mileage affected by various kinds of polluting substances. Special attention was given to the effect of dairy wastes on streams. In addition, an attempt was made to correlate the bottom fauna in polluted areas with the food taken by fish caught in such areas.

161. Faull, J. H. 1913. V. The Algae. In: Faull, J. H. (Ed.). The natural history of the Toronto region, Ontario. Canadian Institute, Toronto. pp. 174-179.

A list of blue-greens, diatoms and greens found in the Toronto area is given. (Toronto-Royal Ontario Museum).

162. Federal Water Pollution Control Administration. 1966a. Lake Ontario program, Great Lakes-Illinois river basins project for water pollution control, Washington, D. C. 15 p.

This informative pamphlet deals with the water pollution control investigations which have been administered by the Federal Water Pollution Control Administration. It is a comprehensive survey of the physical nature and conditions of Lake Ontario and its tributaries. It especially investigates the effects of the toxic and oxygen demanding wastes which are dumped into this water system.

163. Federal Water Pollution Control Administration. 1966b. Great Lakes-Illinois river basins project. Statement on water pollution in the Lake Ontario basin. Prepared for the Natural Resources and Power Subcommittee of the House Committee on Government Operations, Washington, D. C. Unnumbered.

Biological sampling consisted of analysis of benthic fauna, phytoplankton, attached algae, chlorophyll, light penetration and seston. Evaluation of biological conditions in Lake Ontario shows the lake can be classified as tending to become eutrophic. The benthic fauna of the lake indicates oligotrophic conditions. However, the phytoplankton and attached algae problems that occur tend to support a eutrophic nature. The ability of the lake to support algae blooms and great masses of *Cladophora* along the littoral zone is a definite indication of eutrophication. Apparently the major factor that saves Lake Ontario from becoming eutrophic is its deep water.

The microbiological study of the Lake Ontario basin included tributary, mouth, harbor-inshore and extended range stations. The parameters considered in the study were total coliform, fecal coliform, fecal streptococcus and total plate counts.

The section on water uses included a discussion of commercial fishing. The total pounds of fish reported by U. S. fisheries ranged from 233,000 to 351,200 during the years 1960-1964. Yellow perch, carp, eels and white perch were the principal species caught.

164. Federal Water Pollution Control Administration. 1968. Water Pollution Problems and Improvement Needs, Lake Ontario and St. Lawrence River Basins. U. S. Federal Water Pollution Control Administration and NYS Dept. Health, Division of Pure Waters, Albany, New York. 124 p.

The report summarizes the water pollution problems of the United States waters of Lake Ontario and the St. Lawrence River and their tributaries. It identifies the causes of these problems or sources of pollution, discusses the improvements needed and presents a program of recommended actions. The report is based on extensive field and office studies, initiated in 1964 and still continuing, by the Federal Water Pollution Control Administration's Rochester Program Office; and on information on the New York State Health Department.

165. Fenlon, M. W., D. C. McNaught and G. D. Schroder. 1971. Influences of thermal effluents upon aquatic production in Lake Ontario. Abstract of paper presented at the 14th Conference Great Lakes Research, Toronto, April 19-21, 1971. pp. 173-174.

The effects of both heat and radionuclides upon the biotic components of the aquatic ecosystem was determined. It was concluded that significant changes in primary or secondary production in the area of the outfall of a nuclear power plant, or downstream from the outfall were not detected.

Ferguson, R. G. - See: J. C. Budd, No. 80.

166. Ferguson, Robert G. and Henry A. Regier. 1963. Selectivity of four trawl cod ends toward smelt. Transactions American Fisheries Society. 92: 125-131.

Three short-term experiments on selectivity of cod ends with various sizes for smelt, *Osmerus mordax* (Mitchell) were conducted in Lakes Ontario and Erie during 1961. In each experiment the paired tow method was used. Four cod ends were attached alternately to a "Western bottom trawl" fished by the MV Erie I. Estimates of percent retention within 0.3-inch length strata were obtained from a comparison of length-frequency distributions in catches made by the different cod ends fishing approximately the same population of smelt on the same date. Additional information was gained from the weight of catches by different cod ends.

Under the conditions of the experiment, cod and mesh sizes of 1 and 3/16 to 1 and 3/8 inches appeared most suitable for smelt trawling given market preferences as they existed in October, 1961.

Fernando, C. H. - See: Shibru Tedla, No. 549.

167. Fleming, J. H. 1912. The Niagara swan trap. The Auk. 29: 445-448.

This paper gives descriptions and histories of the destruction of whistling Swans (*Olor columbianus*) in the Niagara River. The destruction results from being caught in the rapids above the Niagara Falls. The birds float down the river and over the falls in both night and day. It is suggested that some method of driving the swans away from the falls before they are caught and killed by the rapids.

168. Follett, Richard. 1932. *Salmo Salar* of the St. Lawrence River. Transactions American Fisheries Society. 62: 366-368.

The purpose of this paper is to give a brief account of what has happened to the salmon of Lake Ontario and the Upper St. Lawrence during the 19th century. This account cites reports of great quantities of salmon which were taken throughout the 1800's at various points along the tributaries of the entire lake. All descriptions seem to agree that the demise of the salmon was complete by the mid 1870's. The causes of this demise are many and varied, but one factor seems prevalent; the construction of dams along the paths that the salmon must follow to appropriate spawning grounds.

169. Ford, Marjory A. 1943. Annual landings of fish on the Canadian side of the Great Lakes from 1867 to 1939 as officially recorded. Board of Inquiry for the Great Lakes Fisheries. 91 p.

This report contains a compilation and arrangement from the official statistics of the fisheries of the Canadian portion of the Great Lakes for the period 1867 to 1939. Lake Ontario returns are presented in three divisions - the western portion, the central portion and the eastern portion. Tables 162-221 concern Lake Ontario and include data on the annual landings of black bass, carp, catfish, eel, lake herring, maskinonge, yellow perch, pike, pike-perch, blue pikeperch, sturgeon, lake trout, whitefish and all fish combined for Lake Ontario as a whole (Niagara Falls to Gananoque), western Lake Ontario (west of Rouge River), central Lake Ontario (Rouge River to Brighton) and eastern Lake Ontario (east of Brighton). The data for eels, herring, perch, pike, blue pikeperch, sturgeon, trout and whitefish have been plotted separately to form eight illustrations each of which is divided into four parts for the total, western, central and eastern portions of Lake Ontario. (Univ. of Toronto, Zoology Library).

Forney, John L. - See: Dwight A. Webster, No. 580.

170. Fox, W. Sherwood. 1930. The literature of *Salmo salar* in Lake Ontario and tributary streams. Transactions Royal Society Canada. Section 2, 3rd series. 24: 45-55.

Presents a summary of the literature on *Salmo salar* in Lake Ontario from the early 1800's through the early 1900's.

171. Frick, H. C. 1965. Economic aspects of the Great Lakes fisheries of Ontario. Fisheries Research Board of Canada, Bulletin No. 149. 160 p.

In Lake Ontario there have been problems with the fishing industry. Some of these are inherent in the industry and some are arising out of new developments in the supply. Due to its structure the fishing industry is faced with high fixed costs of operation and declining catch revenues. This is primarily due to a decline in landings of prime species such as lake trout, whitefish, walleye and blue pike. Environmental factors affected by man seem to be favoring increases in low value species such as carp and sheepshead. These problems point to a need for lower unit fishing costs and increased efficiency. The introduction of trawls may be of some help. Other problems with the industry are deficiency of credit, poor management and out-dated processing operations. Changes in market demand along with unethical exploitation at times by wholesale buyers have caused the Lake Ontario fishermen problems. A fish marketing board controlled by the fishermen to increase his bargaining power and mode of operation along with changes of fishery regulations is discussed as a solution. A brief history of the fisheries development on Lake Ontario is included, as well as data on estimated value of fisheries, total landings in pounds of fish, landing of selected species, number of fishermen and many other associated statistics.

172. Fry, F. E. J. 1933a. Spawning dates of sucker and perch at Toronto. Department of Zoology, Univ. Toronto. (Unpublished).

A brief article on the collection of sucker and perch eggs at the Humber River on April 17 and April 20, 1933. (Univ. of Toronto Zoology Library).

173. Fry, F. E. J. 1933b. A preliminary investigation into the effect of the temperature of incubation of the myamere count of ciscoes. Univ. Toronto, Dept. Zoology). 13 p. (Unpublished).

This report is concerned with the racial variations of fishes due to influences of the environment on the embryo during genesis and early development. It has been shown that if the normal environment of developing embryos is altered, "great aberrations" can result in the nature of the organism. The myamere counts which were obtained from this research were unreliable because of the lack of successful hatches of fry. (Toronto, Ontario Fisheries Research Library - Zoology Library).

174. Fry, F. E. J. 1949. Synopsis of activities in fisheries research in Ontario, 1948. Univ. Toronto, Dept. Zoology. 7 p. (Unpublished).

This is a list compiled by Fry which described the current research which is in progress at this time throughout the province of Ontario. Listed as one of the projects under way is an Atlantic salmon experiment at Duffin Creek in Lake Ontario. Another project is the relation of commercial fishing to fish taken by angling in the Bay of Quinte, Lake Ontario. Also listed are the coordinating supervisors, members of the staff and recent publications. (Univ. of Toronto Dept. Zoology).

175. Gage, Simon H. 1893. The lake and brook lampreys of New York, especially those of Cayuga and Seneca lakes. Wilder-Quarter-Century Book: 421-493 + plates.

Two species of lampreys inhabit the chain of lakes in western New York. One, the brook lamprey (*Petromyzon* or *Ammocoetes branchialis*) is small in size, few in numbers and short-lived, in the adult stage. It is not known in North America outside the Mississippi Valley except in the Cayuga Lake basin. It is probably widely distributed, but from its small numbers and inconspicuous coloring, it has been overlooked. The other, the lake lamprey (*Petromyzon unicolor* or *dorsatus*) is of large size, is in great numbers and lives a parasitic life in the lakes for a period of two to three and one-half years, and perhaps longer.

A relatively complete natural history of the lake and brook lamprey is presented together with a comparison of the two species.

176. Gage, Simon H. 1928. The lampreys of New York State - Life history and economics. NYS Conservation Dept., Supplemental to 17th Annual Rept. for 1927. A Biological Survey of the Oswego River System. pp. 158-191.

This report contains information on the life history of the lampreys in New York State. The distinctive characters for identification and distribution of lampreys in included. The economics of the lampreys are discussed with the beneficial aspect being lampreys are edible and can be used for bait and the harmful aspect is their parasitic mode of feeding which kills fish. Included are results of experiments involving the predatory habits of the lampreys and an estimation of damage by lampreys to the fish. The brook lampreys were determined to be non-parasitic and non-injurious. Through experiments, it was determined the lake lamprey lives from 1-1/3 to 3-1/3 years as a parasite on fishes and four to five years as a non parasitic larval. Approximately 3 pounds of blood is required by a lamprey to grow to maturity. Lamprey control methods suggested including killing the adults as they entered the spawning streams.

177. Gannon, John E. and Alfred M. Beeton. 1969. Studies on the effects of dredged materials from selected Great Lakes harbors on plankton and benthos. Univ. Michigan, Center for Great Lakes Studies. Special Rept. No. 8. 82 p.

Changes have been taking place in the environment and biota of the Great Lakes, many of which are attributed to pollution of the lakes. The major harbors of the lakes are among the most polluted environments in the system and concern has developed about the dumping of sediments dredged from these harbors in the open lake. In the Great Lakes dredging and water quality project, field investigations were undertaken to determine: (1) the nature of the environments, (2) the effects of dredging on the harbors and (3) the effects of disposals on the lake environments. Laboratory studies were made of the effect on the biota of sediments from the harbors along the Great Lakes including Great Sodus Bay, New York.

178. Garside, E. T. and W. J. Christie. 1962. Experimental hybridization among three coregonine fishes. Transactions American Fisheries Society. 91(2): 196-200.

This study was originally undertaken to assess the possible relationship of egg (or yolk) size to metameric differentiation of fish embryos in the series of sizes presented by the eggs of the lake whitefish (*Coregonus clupeaformis* Mitchell), cisco (*Leucichthys artedii* Le Seur) and round whitefish (*Prosgsium cylindrocerem* Pallas). Technical difficulties of the moment interferred with rearing the resulting fry of some of these deallel crosses, and the excessive mortality left insufficient numbers to conduct meristic and morphometric studies. This report, therefore, is largely a description of the gross embryological features of the progeny of the corsses. Some measures of mortality and descriptions of abnormal embryos are also presented.

179. Geare, R. I. 1884. The lake whitefish - *Coregonus clupeiformis*. In: Goode, George Brown (Ed.). The fishery industries of the United States. U. S. Comm. of Fish and Fisheries. Section III. Part Q (168): 507-540.

The whitefish is found in all the Great Lakes, as well as in several of the small lakes tributary to them. The largest specimens of whitefish are found in Lake

Superior, weighing as much as twenty-three pounds, while the smallest specimens of whitefish can be found in Lake Ontario where the average whitefish weighs two and a half pounds. In Lake Ontario, about Port Ontario, it is probable that the whitefish migrate from the Canadian shore to the American shore regularly. In 1870, they were more plentiful on the American shore; ten years before that, again, the reverse was the case. The food of the whitefish is chiefly crustacea, mollusks and insect larvae. The chief enemies of the whitefish are the spawneaters of the Lakes which are a numerous and widely distributed list of animals. The destruction of the spawn is immense and far exceeds the losses while in the stage of fry.

Also discussed in the report is spawning and development, artificial propagation and economic importance of the whitefish.

180. Gill, T. 1860. Notes on the nomenclature of North American fishes. Proceedings Academy Nat. Science, Philadelphia. 12: 19-21.

A brief note on *Labrax osculatii* which was obtained in Lake Ontario.

181. Glass, Irvine, et.al. 1909. Lake Ontario and Bay of Quinte. Ontario Game and Fish Dept. 2nd Annual Rept. (1908). pp. 31-35.

These reports are summaries given by overseers of the areas along Lake Ontario and Bay of Quinte. Commercial fish and angling catches are discussed along with illegal activities in each of their districts concerning fishing. (Univ. of Toronto Zoology Library).

182. Glooschenko, Walter A. 1971. The effect of DDT and dieldrin upon ^{14}C uptake by *In situ* phytoplankton in Lakes Erie and Ontario. Paper presented at 14th Great Lakes Research Conference, Toronto, April 20, 1971. (Unpublished).

In situ studies were performed upon the effects of DDT and dieldrin to phytoplankton in Lake Ontario in May, 1970 and Lake Ontario in July and October, 1970. The water samples, concentrations of 1, 10, 100 and 1000 ppb DDT and dieldrin (Lake Erie only) were added. The response of the phytoplankton was measured by ^{14}C uptake over five-hour intervals.

On Lake Ontario, 1 ppb DDT was sufficient to cause a decrease of ^{14}C uptake by 12.3%. On four stations occupied in Lake Erie in July and three in October, DDT at 1 ppb caused decreases in ^{14}C uptake from 14.2-28.1% in July and 1.2-29.1% in October. Dieldrin decreased ^{14}C uptake to a greater extent. A decrease of 30.7-74.7% was found at 1 ppb in July and 9.0-36.4% in October. At the higher concentrations used of 10,100 and 1000 ppb greater reduction of ^{14}C was noticed.

The inhibition of ^{14}C uptake by DDT and dieldrin does not appear to be important in the Great Lakes in situ except possibly in local areas of high runoff from agricultural sources. The major problem appears to be concentration of these pesticides by algae and transfer to higher tropic levels.

183. Goode, G. Brown. 1882. Notes on the life-history of the eel, chiefly derived from a study of recent European authorities. Bulletin U. S. Fish Commission for 1881. 1: 71-124.

Includes brief sections on the classification, distribution, habits, introduction into U. S. waters, ancient beliefs, internal and external characteristics and reproductive habits of the eel. This is followed by an annotated list of papers concerning the eel and its reproduction.

As to their distribution, they were quite abundant in Lake Ontario but unknown in Lake Erie. A possible explanation for their introduction into Lake Erie was given by the captain of a vessel. He said it was quite common to carry live eels in a tub on deck while on Lake Ontario and take them through the Welland Canal. When tired of them or upon getting better fish to eat, the remainder of the eels were simply dumped alive into Lake Erie.

184. Goode, George Brown. 1884a. The fisheries and fishery industries of the United States, Section I. National History of Useful Aquatic Animals, United States Commission of Fish and Fisheries. 895 p.

The purpose of the book is to provide a statistical and historical monograph of the fisheries. The book is divided into the following sections; (1) natural history of marine products, which included the study of the useful aquatic animals and plants of the country, as well as seals, whales, turtles, fishes, lobsters, crabs, oysters, clams, sponges, marine plants and inorganic products of the sea. (2) The fishing grounds which covered the geographical distribution of all animals sought by fishermen and the location of the fishing grounds. (3) Apparatus and methods of capture, including all the forms of apparatus used by fishermen, boats, nets, traps, harpoons, etc...and the methods employed in the various branches of the fishery. (4) Products of the fisheries which included the statistics of the yield of American fisheries, past and present. (5) Preparation, care of, and manufacture of fishery products which included the methods and various devices for utilizing fish after they are caught, with statistics of capital and men employed. (6) The economy of the fisheries.

185. Goode, George Brown. 1884b. The yellow perch - *Perca americana*. In: Goode, George Brown (ed.). The Fishing Industries of the United States. U. S. Commission of Fish and Fisheries. Section III, Part O(139): 414-417.

The article describes the distribution of the yellow perch in America. Mentioned is that at Oswego, Port Ontario, Chaumont and Sackets Harbour, as well as other points on the southern and eastern shore of Lake Ontario, the yellow perch are very abundant.

186. Goode, George Brown. 1884c. The salmon tribe. In: Goode, George Brown (ed.). The Fishery Industry of the United States. U. S. Commission of Fish and Fisheries. Section III, Part Q(160); 468-474.

This chapter of Mr. Goode's book deals with the salmon; their distribution, abundance, habits, reproduction and young fish. Also included in a sepcific reference to the salmon in Lake Ontario, how they were fished and the fact that the numbers of salmon have decreased over the years--the author attributing their decrease to overfishing and pollution of the waters by the mills and factories.

187. Goode, George Brown. 1884d. The namaycush or lake trout (*Salvelinus namaycush*): In: Goode, George Brown (ed). The Fishing Industries of the United States. U. S. Commission Fish and Fisheries. Section III, Part Q(162): 485-496.

The lake trout, or salmon trout, is a non-migrating species inhabiting the chain of Great Lakes from Superior to Ontario, as well as Lake Champlain and many other smaller lakes of the United States and of British America. Certain modifications of structure have resulted from access to nutritious food in almost unlimited quantity and from existence for many generations in extensive bodies of water. The most striking of these is the greater size. The lake trout sometimes attains the weight of one hundred and twenty pounds. They are almost always found in the same lake with one or more kinds of whitefish.

In Lake Ontario the lake trout are found in abundance. Although they rank far below the whitefish, three times as many whitefish as trout are usually taken.

188. Grabill, L. R. 1889. Report of operations at the shad-hatching station on Battery Island, near Havre de Grace, Md., during the season of 1886. U. S. Commission Fish and Fisheries, Rept. for 1886. Part 14: 807-814.

The above is a report on the hatching and distribution of shad at the Battery Island, Md. station. With reference to Lake Ontario, 75,000 rockfish were sent from the Battery Island, Md. station for deposit in Lake Ontario near Oswego.

189. Graham, Joseph J. 1951. The ecology and life history of the alewife (*Pomolobus pseudohangenus*) in Lake Ontario. Univ. of Toronto, Dept. of Zoology. 4 p.

A physiological investigation on the alewife of Lake Ontario was begun in the spring of 1951 at the Southern Research Station of the Ontario Department of Lands and Forests. Experiments were attempted during the investigation included studies on lethal temperatures, osmotic lethal and preferred temperatures. Discussion of mortalities in experimental samples and lethal temperature experiments is included. The other two experiments were not carried out due to extreme mortality of laboratory stocks of alewives due to problems with respiration.

190. Graham, Joseph J. 1954. The morphometry and mortality of the alewife (*Pomolobus Pseudoharengus*, Wilson) in fresh water. Summary of Ph.D. thesis, Dept. of Zoology, Univ. of Toronto. 4 p.

This paper gives a summary of J. J. Grahams Ph.D. thesis. The major aspect of the problem investigated was a study of growth and form carried out to evaluate differences in growth rates and body proportions between Lake Ontario and anadromous, Atlantic alewives. Particular attention was also given to the nature of the annual mortality which is characteristic of *P. pseudoharengus* in Lake Ontario. (Univ. of Toronto, Zoology Library).

191. Graham, Joseph J. 1956. Observations on the alewife (*Pomolobus pseudoharengus* (Wilson) in fresh water. University of Toronto, Biological Series No. 62. 43 p. (Publications of the Ontario Fisheries Research Laboratory, No. 74).

The major study in this investigation was one of growth and form, carried out to evaluate differences in growth rates and body proportions between the landlocked Lake Ontario and the anadromous Atlantic alewives. Particular attention was also given to the nature of the annual mortality that is characteristic of *P. pseudoharengus* in Lake Ontario. The Atlantic alewife has a more rapid rate of growth than the landlocked form. Both groups display early rapid growth followed by a decrease in the growth rate coincident with the onset of sexual maturity. It is suggested that the freshwater environment hastens the onset of maturity with its attendent inhibition of growth. The Lake Ontario alewife matures about one year earlier than the Atlantic salmon. The form of the alewife within Lake Ontario is smaller than the Atlantic form and several comparisons of measurement are presented.

During the alewifes spring entry into shoal water, it sometimes encounters gradients that have maximum surface temperatures approaching 20°C gradients. Alewives were observed to die principally within the upper ranges of these gradients. A correlation between the gradual increase in surface temperature from spring to summer with increase in mortality was also found. Comparison of the range of lethal temperatures found in the laboratory with the lethal ranges of the temperature gradients observed in the field showed that the early incidences of mortality are related to the entrance of the alewives into warm shoal waters in spring while they are still acclimated to the low temperatures of the lakes depths. (Univ. of Toronto, Zoology Library).

192. Graham, Joseph J. 1957. Some observations on the schooling movements of the alewife in Lake Ontario. Canadian Field-Naturalist. 71(3): 115-116.

The alewife (*Pomolobus pseudoharengus*) schools of Lake Ontario exhibit two characteristic movements: The "mill" and the "roller-coaster." In the "roller-coaster" movement the school undulates from the surface of the water to the bottom over a zigzag course frequently breaking the surface. The "mill" is produced by a school forming a circle. The "mill" was observed when a school approached a semi-circular indentation of the shoreline formed by a gravel spit extending into the lake. The school turned toward shore when encountering the spit and in consequence turned at an angle of about 180°. When a school turns at an angle of about 180° fish passing each other in opposite directions exert a greater stimulus than those traveling in the same direction. Thus, the fish on the inside of the turn incline toward each other and members on the outside follow them and soon the school is circling. In laboratory studies, schools will "mill" continuously once the mill is formed unless disturbed.

193. Graikoski, John T. 1965. Microbiological studies on Lake Ontario. Univ. Michigan, Great Lakes Research Division. Proceedings 8th Conference Great Lakes Research. Pub. 13: 211.

Water and bottom mud samples were collected from approximately 17 stations at various depths from the eastern half of Lake Ontario. Both surface and bottom water samples were obtained aseptically. The total number of viable bacteria growing aerobically on nutrient agar at 35°C was determined. Water samples from a few selected stations were also tested for bacteria growing anaerobically. The number of aerobic bacteria varied from 10 to greater than 30,000 per ml (depending on the station), the greater numbers being in the shallow stations, with slightly greater numbers in the samples obtained from the bottom. In the deeper stations, very little differences in the numbers growing aerobically or anaerobically were observed. As expected, the number growing anaerobically was small, although in the samples containing a large number of aerobes there was a correspondingly greater number of bacteria growing anaerobically. Samples of fish cultured aboard vessel, as well as the mud samples, were transported back to the laboratory for analysis as to types of anaerobic bacteria present.

194. Great Lakes Fishery Commission. 1961. Fishery Statistical districts of the Great Lakes. Tech. Rept. No. 2. Ann Arbor, Michigan. pp. 24.

Biologists responsible for fishery research on the Great Lakes recognized early the futility of attempting to follow changes of fish stocks without full and accurate statistics on catch and effect. The only feasible procedure is a reporting system in which the individual fishermen prepare and submit accounts of their daily take and gear fished. Inasmuch as fishing conditions are substantially different in various areas of a single lake, the most effective use of catch effort statistics can be made only if they are sorted according to local areas, or statistical districts. The report states the districts and boundaries found in all the Great Lakes, Lake St. Clair and adjoining waters.

195. Great Lakes Fishery Commission. 1962. Commercial fish production in the Great Lakes 1867-1960. Ann Arbor, Michigan. Tech. Rept. No. 3. 166 p.

Records of the production of fish from the Great Lakes were collected as early as 1867 in Canada and 1879 in the United States. The report is an up-to-date record of the production of the fishery from 1867 to 1960. Includes fish type, pounds and caught per year per species of fish.

196. Great Lakes Fishery Commission. 1966. Summary of regulations relating to commercial fishing on the Great Lakes. Ann Arbor, Michigan. 60 p.

This report is a summary of commercial fishing regulations in the Great Lakes. Concerning Lake Ontario the regulations are broken down into Province of Ontario and State of New York regulations. Included are fish size limits, gill, pound and trap net overall size and net mesh size regulations. Regulations on fishing with seines and trawls is included. Methods of measuring mesh size in Ontario and New York are discussed. Regulations on closed areas, license fees and requirements on reporting fish catch statistics are included.

197. Great Lakes Fishery Commission. 1967. Annual report for the year 1966. Ann Arbor, Michigan. 61 p.

The annual report to the Great Lakes Fishery Commission for 1966, includes a brief summary of the fishing in the Great Lakes. Concerning Lake Ontario they briefly discussed the recently depressed sport and commercial fisheries and measures taking to improve it. Suggestions were presented for increased studies concerning the Sea Lamprey, chemical and thermal pollution and rates of eutrophication in Lake Ontario.

198. Great Lakes Fishery Commission. 1968. Annual report for the year 1967. Ann Arbor, Michigan. 63 p.

The Annual Report for 1967 includes a brief summary of the changes in the commercial fishery in Lake Ontario between 1966 and 1967. The Sea Lamprey is sited as a cause for the decline in whitefish and lake trout populations. Results of Kohanne stocking were included. Also in 1967 a reward was offered to commercial fishermen for sea lamprey caught by commercial fishing gear. A total of 585 were purchased from fishermen on Lake Ontario.

199. Great Lakes Fishery Commission. 1969a. Lake Ontario committee report of annual meeting. Appendix VIII. 4 p. (Unpublished).

The report discusses the commercial fishery in Canadian and U. S. waters of Lake Ontario. The six major species in 1967 and 1968 were carp, white perch, yellow perch, eel, bullheads and smelt. Most of the commercial production continues to come from the shallow waters at the eastern end of the lake while the relatively large expanse of deep-water remains unproductive. A mention of the releasing of coho smolts by the U. S. and the presence of lamprey predatation is included. (Canada Centre for Inland Waters).

200. Great Lakes Fishery Commission. 1969b. Annual report for the year 1968. Ann Arbor, Michigan. 71 p.

This report includes summaries of the management and research; and of trout and salmon plantings on all of the Laurentian Great Lakes. There is a section dealing with the lamprey control program in the U. S. which includes survey reports on chemical treatments, re-establishment in treated streams and population assessments. There is a section dealing with lamprey control in Canada which described electrical barrier operations, lampricide treatments and re-establishment surveys in treated tributaries. (Canada Centre for Inland Waters).

201. Great Lakes Fishery Commission. 1970a. Annual report for the year 1969. Ann Arbor, Michigan. 58 p.

The Annual Report for 1969 included proposals for increased stream survey around Lake Ontario and construction of electrical barriers. The results of the 1969 survey for the Sea Lamprey in Lake Ontario were submitted but not fully published here.

A summary of commercial fishing in Lake Ontario was included with comparisons to 1968. Results of attempted establishment of Lake trout, coho and kokanee were included and the Sea Lamprey problem associated with these species. Included was data on coho, kokanee and chinook salmon plantings in Lake Ontario. A brief summary of sport fishing in Lake Ontario was also included.

A brief summary of the Sea Lamprey in 135 Lake Ontario tributaries on the New York side and Himber River on the Canadian side is included.

202. Great Lakes Fishery Commission. 1970b. Report to the States (1969-1970). Ann Arbor, Michigan. 55 p.

The report is a general review of significant Great Lakes developments in 1969-1970. Included is a report on the Great Lakes fisheries, including catch changes between 1964-1968 and 1969-1970 and the plantings of hatchery-reared yearlings.

203. Great Lakes Institute. 1965a. Annual Report, 1964 PR 18, Toronto. Univ. of Toronto. 47 p.

A general report on the activities of the Great Lakes Institute in 1964. A summary of Great Lakes Institute research projects is given. Among the projects discussed are Great Lakes bottom fauna investigations, study on stream crayfish in a Toronto Island canal and Great Lakes plankton studies.

204. Great Lakes Institute. 1965b. Annual report PR 25, Univ. Toronto, Toronto, Ontario. 55 p.

A general report on the activities of the Great Lakes Institute from 1964-1965. A summary of research papers and programs is given. Included is a study of crayfish in streams, plankton sampling and bottom sampling.

205. Great Lakes Institute. 1968a. Annual report PR 31, Univ. Toronto, Toronto, Ontario. 70 p.

A general report on the activities of the Great Lakes Institute during 1967. A summary of research projects on the Great Lakes is given. The projects include studies of the benthos of Lake Ontario and Lake Erie, ecological factors influencing the parasite fauna of yellow perch and white perch in the Bay of Quinte, zooplankton investigation in the Bay of Quinte and phytoplankton distribution in Lake Ontario in relation to the thermal bar.

206. Great Lakes Institute. 1968b. Annual report, PR 35, Univ. Toronto, Toronto, Ontario. 42 p.

A general report on the activities of the Great Lakes Institute during 1968. Included in the report is biological, chemical, physical data taken by the Porte Dauphine, the research vessel of Great Lakes Institute in a survey from January to December in the Great Lakes. Included also is a summary of a study that is being done on Lake Ontario, it is called Stuides of the Phytoplankton in the Great Lakes, Phytoplankton Distribution in Lake Ontario.

207. Great Lakes Institute. 1969. Annual report, PR 40, Univ. Toronto, Toronto, Ontario. 31 p.

A general report on the activities of the Great Lakes Institute during 1969. A summary of research projects on the Great Lakes is given. The projects include a study on the phytoplankton in the Great Lakes.

208. Greeley, John R. Undated. Conservation of the black bass resource of the Lake Ontario St. Lawrence Region. NYS Conservation Dept. Leaflet, Albany, New York. 10 p.

The waters of Lake Ontario and the St. Lawrence River comprise the largest and most important small mouthed bass region in New York State. The supply of bass has held up well in this region in general although some local areas have decreased in bass population. Bass size average rather samll due to poor growth in early age and heavy fishing pressure resulting in few fish of the older age groups. A change of regulation lowering the limit of 10 bass per person to 6 is recommended. Environmental factors limiting bass production include competition of other fish living on the same grounds and utilizing the same food. Control of commercial fisheries and other modification of fish population have important actual or potential bearing on the problem of bass production. Present bass stocking results in these waters are of questionable value and improvement of the supply through further expansion of planting cannot be assumed. Consideration of the entire fisheries management plan for the unit of water involved is recommended as the most likely method for improveing bass fishing by developing, testing and applying management fitted to improve carrying capacities, control harvesting and assume replacements adequate to maintain a sustained level of fisheries. (Univ. of Toronto, Zoology Library).

209. Greeley, John R. 1927. Fishes of the Genesee region with annotated list. Supplemental to 16th Annual Report for 1926, NYS Conservation Dept, Biological Survey. pp. 47-66.

The Genesee River rises in Pennsylvania and flows northward across the State of New York to enter Lake Ontario. Sixty-six species of fish are listed as occurring in this region including food and game fishes, fishes used as food by the game fishes and those miscellaneous fishes which are of no direct use to man. The ecology of the numerous kinds of fishes is also described with a special emphasis to the effects of pollution on fish.

210. Greeley, John R. 1928. Fishes of the Oswego watershed. Supplemental to 17th Annual Report for 1927, NYS Conservation Dept., A Biological Survey of the Oswego River System. pp. 84-107.

During the summer of 1927, extensive investigation of the fishes of the entire Oswego watershed was carried out. Included is a description of the area and distribution of fish in the watershed, a list of food and game fish, non-habitat preferences, fish associations, trout stream associations, vermin fishes, fishes in regard to pollution and minnow tests for pollution are mentioned. Color plates of some fish and lampreys, an annotated list of fishes occurring in the Oswego River drainage, charts on fish distribution and food of some Oswego drainage fishes in included.

211. Greelye, John R. 1929. A biological survey of the Erie-Niagara System. VI. Fishes of the Erie-Niagara Watershed. Supplemental to 18th Annual Report for 1928. NYS Conservation Dept., Albany, New York. pp. 150-179.

This program included a study of the fish life of the region. The problem was: to gather data regarding the distribution and habits of the various fishes; the conditions of environment under which they are found; their relative abundance; and their relative economic importance. Collections were supplied for stomach examination, physiological examination; and for parasite examination.

Collections were made from throughout the system, from which a distribution of the food, game and commercial fishes were compiled. A group of factors contributing to a decline of fish numbers have been listed which are followed by suggestions and recommendations. A chart of fish distribution through the watershed and an annotated list of fishes is also included.

212. Greeley, John R. 1940. A biological survey of the Lake Ontario watershed. II. Fishes of the watershed with annotated list. NYS Conservation Dept., Supplemental to 29th Annual Report for 1939, Biological Survey, Albany, New York. pp. 42-81.

The distribution and relative abundance of the fishes of the region are discussed from an analysis of 522 survey collections. The annotated list of species comprises 100 forms taken in field collections with 10 additional ones recorded on the basis of literature or previous collections.

Data bearing upon growth rate of 12 species are presented. Various aspects of the problem of managing the fish resources on a sustained yield basis are dealt with. Natural reproduction, involving various population units, is considered more important in maintenance of resources than stocking and attention is directed toward the need for maintaining and improving environments, controlling undesirable fish and improving regulations. Lake Ontario has a relatively smaller percentage of shallow, productive areas than others of the Great Lakes and its fishing areas are under heavy pressure of commercial fishing and angling. Fisheries of the lake have been depleted to the point of supporting a smaller annual crop than would be possible under regulations adjusting the take to a maximum sustained yield.

213. Greeley, John R. 1948. Four years of landlocked salmon study. NYS Conservation Dept., Fish and Wildlife Information Bulletin. No. 2. pp. 1-16.

The article contains a brief note on the presence of landlocked salmon in Lake Ontario. (Univ. of Toronto Zoology Library).

214. Greeley, John R. 1955. White bass. NYS Conservationist. 10(1): 29.

The white bass is a fine sport fish to be taken in New York State. However, it has a restricted range and comparatively few anglers have ever seen it. Its range extends to Lake Ontario. A few hundred pounds of white bass are taken each year in Lake Ontario. Some of its ecology, fishery aspects and identifying characteristics are discussed.

215. Greeley, John R. 1956. The lamprey in New York waters. New York State Conservationist. 11(1): 18-21.

Contains a description of the sea lamprey with special reference to its occurrence in Lakes Ontario, Erie, Champlain, Cayuga, Seneca and Oneida. Also included is a discussion of lamprey control as it applies to the New York situation.

216. Greeley, John R. and S. C. Bishop. 1932. Fishes of the area with annotated list. Supplemental 21st Annual Report for 1931, NYS Conservation Dept., Biological Survey. 6: 54-93.

This paper is a study of particular fish problems of Lake Ontario-St. Lawrence watershed along with a general collection of fish from the investigated area. The function of the survey was to discover and define fisheries problems that are in need of special study. Included in the paper is an annotated list of fish of the region, charts on fish distribution in the watershed, important economic fishes and information on the spawning habits of bass and the nests and fry of lake catfish.

217. Green, Seth. 1874a. Report on shad-hatching operations. U. S. Commission Fish and Fisheries. Report for 1872-1873. Part 2. pp. 405-406.

The author reports hatching 7,500,000 shad and placing 50,000 in Oneida Lake and 50,000 in the Genesee River in 1872. The year before he placed 15,000 young shad in the Genesee River. As a result, he says he could take 20 shad averaging over 7" long per haul with a twenty-rod seine at the mouth of the river in Lake Ontario.

218. Green, Seth. 1874b. Shad in Lake Ontario. Forest and Stream. 2(19): 292.

An account of a successful attempt to propagate shad in Lake Ontario is given. The author reports large quantities of shad are being caught at Port Dalhousie on the north side of Lake Ontario, and quite a few are taken in nets at other points.

219. Green. Seth. 1882. Salmon caught in Genesee River, New York. Bulletin U. S. Fish Commission for 1881. 1: 23-24.

Contains a brief note on the occurrence of five salmon weighing an average of 3-10 lbs. in the Genesee River.

Green, C. Willard - See: Carl L. Hubbs, No. 262.

220. Greene, C. W. 1940. A biological survey of the Lake Ontario watershed. I. Stocking policy for the Ontario watershed with suggestions for other fish management methods. NYS Conservation Dept., Supplemental 29th Annual Report for 1939, Biological Survey. pp. 20-41.

Reports on each body of water in the survey area have been made by various groups of the survey organization. These data are directed primarily toward acquisition of a basis for an improved stocking policy but they form a basis also for the improvement of fishing conditions by other management methods.

The stream unit is concerned with recording this information on the stream and also with preparing maps, assembling survey data for filing and applying the data in the formulation of a stocking policy.

It is believed that characteristics of fish populations of the waters studied give the most practical single basis for a stocking policy but lack of complete information of this kind necessitates using additional physical and biological information, including temperatures, food and pool evaluations, etc. Improvement of the experimental basis for the details of a stocking policy is as necessary as more extensive field data.

The Salmon River and the Irondequoit Creek are the best trout streams of the area. The Salmon River is notable for the excellently preserved natural conditions and for an interesting association between the native brook and introduced rainbow trout in and above Redfield Reservoir. Irondequoit Creek, although located in a suburban area, still maintains good fishing for brown and rainbow trout. Other streams are lowland waters producing principally warm-water fishes; they are generally unimportant as fishing waters.

An extensive habitat characteristic of this area is comprised by the estuaries and creek mouths which supplement the fish-producing waters of Lake Ontario. They serve as spawning and rearing places for several Lake Ontario fishes and as forage areas for others. They vary considerably in the kind and extent of facilities provided for the migrant species. Periodic concentrations of game fishes in some of these estuaries attract corresponding concentrations of anglers.

Subjects worthy of special consideration and study in this area are: Management of the estuaries, possibilities and competitive aspects of rainbow trout in the upper Salmon River and the advisability of transfers of wild trout from crowded to underpopulated waters.

221. Greene, C. W., R. P. Hunter and W. C. Senning. 1932. Stocking policy for streams, lakes and ponds in the Oswegatchie and Black River systems (including also the lesser tributory streams of the Upper St. Lawrence and of Northeastern Lake Ontario). Supplemental 21st Annual Report for 1931, NYS Dept. of Conservation, Biological Survey. 6: 18-53.

The report gives a thorough description of the procedures involved in stocking lakes and streams with fish. Included is a description of the personnel involved and how they are organized in relation to the stocking project; different procedures for numbering streams, the purpose being to be able to identify each stream in the drainage area. Also discussed were the factors upon which the stocking policy is based, i.e. - temperature, chemical requirements, food, etc.

222. Hallam, J. C. 1959. Habitat and associated fauna of four species of fish in Ontario streams. Journal Fisheries Research Board Canada. 16(2): 147-173.

Four species of fish found in Ontario streams can be divided into two distinct groups on the basis of habitat and associated fauna. *Salvelinus fontinalis* (Mitchell) and *Cottus bairdi* Girard are found associated in cool source waters whereas *Ambloplites rupestris* (*Rafinesque*) and *Micropterus dolomieui* Lacepide occur together in warmer downstream waters. The latter group has more associated species of fish than the former. Some invertebrates such as certain stonefly and mayfly nymphs occur frequently with fish of one group and rarely with fish of the other group. They may be useful as indicators of waters likely to be inhabited by or suitable for the species of fish with which they are frequently associated.

The sampling area consisted of rivers and creeks which enter Lake Ontario at intervals which extend over about 80 miles of the north shore in the Toronto region.

Hamilton, A. L. - See: R. O. Brinkhurst, No. 76.

223. Hankinson, T. L. 1923. The creek fish of western New York. Copeia. No. 115. pp. 29-33.

A study of small streams in the western part of New York State was undertaken during the summers of 1920 and 1921. The Lake Ontario drainage, the Lake Erie drainage and the Ohio River drainage were the three basins included in the study. With reference to the Lake Ontario drainage, only 2 streams were examined which were Twelvemile Creek and Wilson Creek. The paper gives a summary of notes, principally on the occurrence of species, in the form of an annotated list.

224. Harkness, William J. K. 1927a. Ciscoes of Lake Ontario. Manuscript: Univ. Toronto, Dept. of Zoology. 3 p. (Unpublished).

Studies on the ciscoes of Lake Ontario near Port Credit between May 1925 and April 1925 indicate that there are two species of ciscoes (lake herring) of economic importance in this region. *Leucichthys artedi* is the common shallow water "herring." In recent years its numbers have been greatly reduced and the great increase in Ling, *Lota maculosa* , may have been a factor. The recent scarcity of the alewife may have caused greater predatation by the Ling on the ciscoe. *Leucichthys riighardi*, the ciscoe of the Port Credit fishermen, is a deep water species found commonly at 250-400 feet and does not reach a large size and few are caught in a 3 inch mesh gill net. Three other species are found in Lake Ontario: *Leucichthys prognathus*, *Leucichthys hoyi* and *Leucichthys kiyi*. (Univ. of Toronto, Zoology Library).

225. Harkness, William, J. K. 1927b. Whitefish investigations, 1926-27. Univ. Toronto, Dept. Zoology. Unnumbered. (Unpublished).

This investigation of the whitefish included: observations of spawning whitefish at the Provincial Hatchery at Belleville, Ontario· discussion of the distribution of fry in the Belleville area; an effort to locate the spawning grounds of whitefish; a determination of the fertility of those eggs naturally deposited; to determine the causes of egg casualities. (Toronto Ontario Fish. Research Library, Zoology Library).

226. Harkness, William J. K. 1930. Ontario fisheries research laboratory. Trans. American Fish. Society. 60: 178-181.

A short article on the establishment of Ontario Fisheries Research Laboratory which was organized by the Univ. of Toronto. Included is the objectives of the research laboratory, personnel involved and accomplishments to date.

227. Harkness, William J. K. 1936. Game fishing. U. S. Commercial Fishing in Inland Lakes. Univ. of Toronto, Dept. Zoology. 13 p. (Unpublished).

The paper discusses the game fish and commercial fishing in the Great Lakes and the inland lakes of Ontario. The author states that the Great Lakes are naturally commercial fish water whereas the inland lakes are primarily game fish waters. Included is the value of the commercial fishery at the present time, the value of the game fish and the necessity of protecting them. The information and statistics are then applied to a situation in Lake Nipissing. (Univ. of Toronto, Zoology Library).

228. Harkness, William J. K. 1945. The determination of maximum yield of the Lake Ontario whitefish fishery. National Committee Fish Culture, Toronto, Ontario. 4 p.

This paper is a report of data collected from eastern Lake Ontario whitefish concerning length and weight. The program of research is not included but is in the Proceedings 1944 and 1945 Results are in graph form. Scale and Fish Statistics for 1945 are discussed. (Univ. of Toronto, Zoology Library).

229. Harkness, William J. K. and J. R. Dymond. 1961. The lake sturgeon. Ontario Dept. Lands and Forests, Fish and Wildlife Branch, Toronto, Ontario. 121 p.

The pamphlet discusses the sturgeon, its size, color, kinds, distribution, habits, type of food, growth rates and reproduction. Included is an interesting record of record size sturgeon taken at different places, one of which was 230 lbs, 6'7" long taken on the Niagara River on October 28, 1946. The author mentions the history of the sturgeon fishery, attributing the decline of the fishery to unfavorable environmental changes. Included also is a list of predators, parasites and diseases of the sturgeon. (Ontario Dept. Lands and Forests Maple).

230. Harkness, William J. K. and A. G. Huntsman. 1928. Dead alewives on Lake Ontario. Correspondence to Seth Gordon, Conservation Director, Isaac Walton League of America, Chicago, Illinois.

This series of correspondence between Seth E. Gordon and W. J. K. Harkness, Dept. of Biology, Univ. of Toronto occured during the summer of 1928. It describes a destruction of the alewives (fish kill) which occurred on Lake Ontario between Lewiston and Toronto, as well as near the eastern end of the Lake. (Toronto Ontario Fish. Research Library, Zoology Library).

231. Harman, W. M. and C. O. Berg. 1971. The freshwater snails of central New York. Cornell University Agricultural Experiment Station, Ithaca, New York. 1(4): 1-67.

This paper provides descriptions, illustrations and usable keys for identification of the freshwater snails and limpets of central New York, including the Oswego watershed. Presented is information on their distribution and ecology, and relation of their distribution to regional geology and limnology.

232. Harrington, R. W., Jr. 1947. The early life history of the bridled shiner, *Notropis bifrenatus* (Cape). Copeia. 2: 97-102.

The known range of *Notropis bifrenatus* extends through the Atlantic coastal drainage from Southern Maine and New Hampshire south to the Potomac River system of Virginia and westward through Lake Champlain, the St. Lawrence River and Lake Ontario drainage. It inhabits ponds, lakes and rivers but only in shallow sections with still or slowly flowing water. It can be found over mud, silt or detritus although it prefers moderate to abundant vegetation. The author was able to obtain fertilized eggs by artificial means with which he studied embryo genesis and early development.

233. Harris, Edward. 1906. The Ontario commercial fisheries. How and why destroyed. Pamphlet, Univ. Toronto, Dept. Zoology. 30 p.

In 1899, the "Ontario blight" struck the fisheries, decreasing the yearly catch of nearly 5,000,000 lbs. At the same time, the year's catch was valued at $300,000 more than the previous year. Such inflated prices are misleading to those people who do not compare these figures to other previous years. Thus, it seems as though the fisheries are more productive. Since ninety-five percent of the catch is exported to America, the only benefit to Ontario is the income from revenues levied on the fisherman. The report also described the unfavorable aspects of the nets used by commercial fishermen. (Univ. Toronto, Zoology Library).

234. Hart, J. S. 1952. Geographical variation of some physiological and morphological characteristics in fish. Univ. Toronto, Biological Series 60. 79 p.

Study of the geographic variation of lethal temperatures and diagnostic morphological characteristics in ten species of fresh water fish showed that the variability was relatively greater for the morphological characteristics. No evidence was found for physiological as distinct from morphological races and many of the species studied possessed uniformity in lethal temperatures from Ontario to Tennessee to Florida. As a result, the lethal temperature findings did not confirm the accepted taxonomic status in several species with recognized subspecies over this range. In others with geographic differences in lethal temperatures, there was agreement with the taxonomic status. (Toronto Ontario Fish. Research Library).

Hart, John Lawson - See: J. R. Dymond, No. 149.

235. Hart, John Lawson. 1929. The capture of young whitefish in the Bay of Quinte. Science. 70: 284.

A short report on the capture of young whitefish in the Bay of Quinte. The fry were taken close to shore in water of depth of three feet or less on numerous occasions between April 12 and June 4, 1928. The capture and observation of the fry over a period of seven weeks provided material which yielded valuable information on the early growth, food and habits of the important commercial species.

236. Hart, John Lawson. 1930. The spawning and early life history of the whitefish, *Coregonus clupeaformis* (Mitchell), in the Bay of Quinte, Ontario. Univ. Toronto, Ph.D. thesis. 105 p.

The common whitefish, *Coregonus clupeaformis* (Mitchell), occurs through the Great Lakes. The value of the Canadian whitefish fishery is greater than one and a half million dollars annually and is the most valuable of the fresh water fisheries.

Material for study of spawning and fry were collected in the Bay of Quinte. Spawning usually occurs in the first week in November. The temperature at which spawning begins varies from 4.5°C to 10.0°C. A high proportion of eggs are fertilized in nature-about 65-100% although these figures vary. Large numbers of whitefish eggs were found to be destroyed by other fish, particularly the perch. The temperatures of the water during the development period were between 0.0°C and 0.8°C. Adequate oxygen appears to be present. In 1928, hatching occurred about the middle of April. Newly hatched fry are active swimmers and keep near the surface. Schooling occurs within two weeks of hatching and fry tend to concentrate in water under 18 inches in depth. At about four weeks fry venture into water of three to four feet in depth but remain close to surface and by the end of May they leave the shallows and in July they appear to be in bottom water of medium (50 ft.) depth. Descriptions of the eggs and fry are given and compared to ciscoes. Whitefish fry growth is slow at first then increases rapidly. Data on growth is presented. Early food consist of Entomostraca followed by insect larvae and amphipods. Chief associates of whitefish young are of the ciscoe with which it directly competes for food. It is recommended that planting of hatchery fry be made close to gently sloping shores and that the fry be widely distributed. The numbers of perch should be reduced in the spawning area. (Toronto Ontario Fish. Research Library).

237. Hart, John Lawson. 1931a. The spawning and early life history of the whitefish, *Coregonus clupeaformis* (Mitchell) in the Bay of Quinte, Ontario. Contributions to Canadian Biology and Fisheries. New Series. 6(7): 165-214.

The spawning run of whitefish is described in respect to the details of the migration and sex ratio, age and size, and breeding characters of the fish. An investigation of the eggs in the spawning grounds by the use of a pump indicates that the proportion of eggs to be fertilized is high but that there is a high mortality during the development. Many whitefish eggs are eaten on the spawning grounds by the common perch (*Perca flavescens*). For the first time there is recorded the capture of a complete series of whitefish young of the year. Based on this material are descriptions of the stages of the young from twelve millimeter to eighty millimeter stages and the characters differentiating whitefish from cisco. The rate of growth of the fry is slow at first but is much accelerated in the latter part of May and until the end of July. The food from the first consists of Entomostraca, chiefly *Bosmina*, *Daphnia* and *Cyclops*. The first movement of the newly hatched fry is in shore close to the surface. Later they form schools and finally take to deeper water. Records of physical conditions in the habitat of young whitefish are recorded. Consideration of the food and other habits and the concentration of predaceous species where young whitefish are abnormally abundant leads to the recommendation that hatchery fry should be widely distributed in shallow water.

238. Hart, John Lawson. 1931b. The growth of the whitefish, *Coregonus clupeaformis* (Mitchell). Contr. Can. Biology and Fish. 6(20: 427-444.

Rates of growth for whitefish from four localities in Lake Ontario, from Lake Nipigon and from Shakespeare Island Lake have been studied by the scale method. Fish from the two northern lakes grow less rapidly than those from Lake Ontario localities. The considerable variation among the latter can be explained in part by the selectivity of nets and overcrowding near much frequented spawning grounds. The weight is proportional to a power of the length, the power being in the neighborhood of 3.4. A study of proportionate measurements shows that male fish have longer fins than females and that there is considerable change in the form of a fish with growth. This is related to the excess over the cube relationship between weight and length. Large fish have smaller heads and eyes and greater depth and interorbital width. It is suggested that races and types of fish may be produced by the character of the habitat in which they live. There is no change with growth in the proportion of total weight to weight of viscera.

239. Hart, John Lawson. 1931c. The food of the whitefish *Coregonus clupeaformis* (Mitchell) in Ontario waters, with a note on the parasites. Contribution Canadian Biol. and Fish. 6(21): 445-454.

A study of the food of whitefish from various localities shows that the whitefish is a bottom feeder, showing little selectivity, accepting the most abundant animal food in the locality. The diet for the first five years in one locality included considerable amounts of plankton. Whitefish eat little on the spawning migration but feed to some extent at least, during the winter.

Ninety-five percent of whitefish examined were parasitized by large numbers of the tapeworms *Cyathocephalus americanus* and *Ichthyotaenia larvie*. A similar number were parasitized by a species of *Echinorhynchus*. Nematode parasites were found in fewer specimens and in small numbers. Crustacean parasites were comparatively rare

240. Hart, John Lawson. 1931d. On the daily movements of the coregonine fishes. Canadian Field-Naturalist. 45(1): 8-9.

In Lake Nipigon an experiment was performed to determine movements of some coregonine fishes. A gang of gill nets was lifted at sunrise and sunset of each day and was returned to the water in the same place immediately after removing and recording the fish taken in it. The results showed that more coregonine fish were caught during the night than day indicating greater activity at night. However, a similar experiment was performed in water of greater depth in Lake Ontario and the results failed to corroborate.

241. Hart, John Lawson. 1933. Another blue perch. Copeia. No. 1. 34 p.

Contains a brief note on the occurrence of a blue perch on November 8, 1927 in the Bay of Quinte, Lake Ontario.

242. Heard, William H. 1962. The Sphaeriidae (Mollusca: Pelecypoda) of the North American Great Lakes. American Midland Naturalist. 67(1): 194-198.

The mollusk fauna of the Great Lakes is not well known, and the sphaeriid clams have never been recorded. Although ignored until recently, specific identification is necessary when studying food relationships, parasitology and distribution. Lists of sphaeriids from each of the Great Lakes reveal that Superior has 6 species; Lake Michigan, 20; Lake Huron, 20; Lake Erie, 14; and Lake Ontario, 26 species. Among the sphaeriids, some species are more common than others, and occurrence varies with depth of water and type of substrate.

243. Hedrick, L. R. and Marjorie Soyugenc. 1967. Yeasts and molds in water and sediments of Lake Ontario. Proceedings 10th Conference Great Lakes Research. pp. 20-30.

Yeast and molds were isolated from 27 widely distributed stations in Lake Ontario. Each station represented 4 samples, three from the water, i.e. the surface depth of 1 meter, the mid-depth and near the bottom. One sample was also taken from the bottom sediment. Organisms from the water were collected by filtration through membranes and cultured on a defined agar medium. The sediment samples (each 6.0g wet wt.) were suspended in 100 ml of the defined liquid medium and four 10 ml portions of this suspension were pulled separately through membrane filters. These filters were then incubated on the defined agar medium. Colonies of representative fungi, which had grown within a period of 24 to 72 hours, were isolated by culturing them upon slants for later identification.

Twenty species of yeasts, representing 7 genera, were identified. Eight genera of molds were isolated. The density distribution of fungi with respect to the depth of the water samples showed that the frequency of occurrence increased with depth. For the 27 stations, the average number of yeasts isolated per 100 ml was 10 at a depth of 1 meter, 130 for water at mid-depth and 460 for water near the bottom; the average number of yeasts in the sediment sample was 46. The respective values for molds were 6, 16, 16 and 11.

Stepwise, multiple correlation analyses did not reveal any consistent association of any one parameter with the distribution of the two most numerous species *Candida guilliermondii* and *Rhodotorula mucilaginosa*. For the total yeast population there was a definite relationship between the numbers of cells at different water depths and the organic nitrogen concentrations at the corresponding depths.

244. Henderson, Croswell; Wendell L. Johnson and Anthony Inglis. 1969. Organochlorine insecticide residues in fish (National Pesticide Monitoring Program). Pesticides Monitoring Journal. 3(3): 145-171.

As a part of the National Pesticide Monitoring Program, fish were collected from 50 sampling stations located in the Great Lakes and in major River basins throughout the United States. Three composite samples, consisting of five adult fish of each of three species, were collected at all stations during the spring and fall of 1967 and 1968. The composite whole fish samples were analyzed by commercial laboratories for residues of 11 organochloride insecticides--DDT and/or metabolites were found in 584 of the 590 composite samples, with values ranging to 45 ppm (mg/kg wet weight, whole fish). Dieldrin was found in 75% of the samples, with values ranging upward to nearly 2 ppm. Other organochlorine insecticide residues were found in fewer samples, but come had fairly high residue levels. Relatively high residues of DDT and metabolites, dieldrin, heptachlor, heptachlor epoxide and chlordane were found consistently during all sampling periods at some stations.

245. Henley, Robert J. 1967. Water Quality Influences on Outdoor Recreation in the Lake Ontario Basin. Proceedings 10th Conference Great Lakes Research. pp. 427-440.

This paper discusses the water quality influences upon present and future use of outdoor recreation resources in the United States portion of the Lake Ontario Basin. Waters of poor quality have had deleterious effect upon recreational activities. Indicators at public recreation areas that substantiate this viewpoint are high bacteria counts, large masses of algae and aquatic plants, mass die-off of fish, and water turbidity problems all of which have resulted in decisions of responsible officials to ban swimming at a few public beaches. An analysis of the influence of poor water quality upon swimming is made to establish an indication of the value to recreation of pollution control.

246. Henson, E. Bennette. 1966. A review of Great Lakes benthos research. The Univ. Michigan, Great Lakes Research Division. Pub. 14: 37-54.

Research attention to the earth-water interface and to the associated plant and animal populations inhabiting the bottom substrata of the Great Lakes has recently both gained in intensity and changed in emphasis. Descriptive biotic surveys are still greatly needed in Great Lakes research; but with the informative background now accumulated, investigations are able to proceed in directions that answer the key questions of "why" and "how" rather than "what." An objective of this article is to focus attention to Great Lakes benthos research that serves as an oar in the movement of future limnological understanding. A focus on contemporary research must be considered in terms of both the past and the future to appraise results and to confirm or re-establish courses of action. An effort if made here to contribute to unified knowledge of Great Lakes benthos by adopting one vantage point and bringing out salient aspects, summarizing present investigations, evaluating benthos composition, and refocusing this in terms of temporal dynamics. The selected vantage point will consider the benthos as an entity in geologic time subject to the eutrophic forces of biological succession.

247. Herbert, Henry William. 1859. Frank Forester's Fish and Fishing of the United States and British Provinces of North America. George E. Woodward, New York City, N. Y. 521 p.

The book in which the author describes the game fish of New York. He includes descriptions of the salmon, pike, carp, herring, catfish, eel and perch families. Also included are shoalwater fishes, deep sea fishes and different types of fishing. Within his descriptions of the fish he includes their habitats and locations.

248. Herbst, Richard P. 1969. Ecological factors and the distribution of *Cladophora glomerata* in the Great Lakes. American Midland Naturalist. 82(1): 90-98.

Included in this paper is a sketch of *Cladophora* distribution in the Great Lakes. Lakes Erie and Ontario were observed to have extensive *Cladophora* growth along most of their shorelines and these growths were found to be most prevalent in association with larger cities and their municipal outfalls.

Herrington, H. B. - See: R. O. Brinkhurst, No. 76.

249. Herrington, H. B. 1947. *Acella haldemani* in Ontario, Canada. Nautilus. 61: 20-25.

Acella haldemani Deshayes is one of our rarest and most graceful shells. Its scarcity has precluded the accumulation of information on its life history. The purpose of this paper is to record observations and comments on this snail in Ontario.

Mentioned is the general distribution of the snail and comments on its habitat and reproductive cycle.

250. Hile, Ralph. 1932. Fish scales and commercial fisheries. The Fisherman. 1(10): 3-4, 10.

The use of fish scales is an indication of the fishes age is presented in general terms. Descriptions of methods of analyzing annuli or year marks is included. References are made to previous work done on herring and chubs in Lake Ontario.

251. Hile, Ralph. 1952. Twenty-five (25) years of federal fishery research on the Great Lakes. U. S. Dept. Interior Special Scientific Report. Fisheries No. 85. 48 p.

The major purpose of this publication is to present an annotated bibliography of papers resulting from Federal investigation on the Great Lakes fish and fisheries since the formal initiation of a continuing research program by the Fish and Wildlife Service.

The annotated list includes the principal publications of staff members of Great Lakes Fishery Investigations. Omitted have been papers resulting from work not associated with Great Lakes research, reviews and numerous processed memoranda and informational releases of only temporary value, prepared for administrative use or given restricted distribution. (Univ. of Toronto, Zoology Library).

252. Hile, Ralph. 1957. U. S. Federal fishery research on the Great Lakes through 1956. U. S. Dept. Interior Fish and Wildlife Service. Special Scientific Report. Fisheries No. 226. 46 p.

The major purpose of this publication is to present an annotated bibliography of papers resulting from Federal Investigations on the Great Lakes fish and fisheries since formal initiation of a continuing research program by the Fish and Wildlife Service. A summary of Great Lakes Fishery Investigations shows that Lake Ontario has received very little attention when compared with the other Great Lakes. (Univ. of Toronto, Zoology Library).

253. Hile, Ralph. 1966. U. S. Federal research on fisheries and limnology in the Great Lakes through 1964: An annotated bibliography. U. S. Dept. of Interior, U. S. Fish and Wildlife Service. Special Scientific Report. Fisheries No. 528. 53 p.

The annotated bibliography is proceeded by a breif account of the Federal research program in fisheries and limnology in the Great Lakes in 1957-64. The bibliography covers 314 papers by staff members of the Bureau of Commercial Fisheries Biological Laboratory in Ann Arbor, Michigan, and 35 by associated scientists with whom the Laboratory had contractual or other cooperative arrangements; included also are patents issued to Laboratory personnel. A roster of Laboratory scientists as of December 31, 1964 is appended.

254. Hile, Ralph and H. J. Deason. 1934. Growth of the whitefish, *Coregonus clupeaformis* (Mitchell), in Trout Lake, Northeastern Highlands, Wisconsin. Transactions of the American Fish. Society. 64: 231-237.

A study of the growth of whitefish in Trout Lake, Wisconsin was compared to the growth rate of whitefish from other North American lakes including Lake Ontario near Pleasant Point done by Hart, 1931.

255. Hiltunen, Jarl K. 1966. Moss from the bottom of the Great Lakes. The Michigan Botonist. 5(2): 62-63.

Aquatic mosses are not uncommon, but records of deep-water species are few, and none may exist for the Great Lakes. Specimens of *Fissidens* from bottom samples from Lake Ontario, Erie, Superior and Michigan have been noted. Apparently, this genus is widely distributed in the Great Lakes, especially in places where there is a hard clay substrate.

256. Hiltunen, Jarl K. 1969. The benthic macrofauna of Lake Ontario. Great Lakes Fishery Commission, Ann Arbor, Michigan. Tech. Report # 14. pp. 39-50.

The presence and relative abundance of bottom macro-fauna in Lake Ontario are documented. Bottom samples were collected at 24 stations in September 1964. The quantity of organisms and the distribution of some species were affected by depth of water. Samples from the shallower stations (47.5 m or less) yielded an average of 41,631 organisms per m whereas the deeper stations (91.5 m or more) yielded an average of only 7,938. The Oligochaeta, the most abundant group of macroinvertebrates, were represented by four families - Enchytraedae, Lumbriculidae, Naididae and Turificidae. The lumbriculid worm, *Stylodrilus heringianus* and the burrowing amphypod, *Pontoporeia affinia*, were rare or absent in areas affected by pollution. In kinds and abundance or organisms, the bottom fauna in Lake Ontario was generally similar to that in Lake Michigan.

257. Hohn, Matthew H. 1951. A study of the distribution of diatoms (Bacillarieae) in Western New York State. Cornell University Agricultural Experiment Station. Memoir 308. 38 p.

The area included in this study was classified into three main divisions according to their ultimate means of drainage - the Lake Ontario drainage system, the Allegheny River drainage system and the Chemung - Susquehanna River drainage system. The Lake Ontario drainage system covered 24 stations located on the south shore of the lake from the Niagara River to Oswego including tributaries. The diatom flora of Western New York, as revealed in this study, includes 430 species and varieties representing 43 genera in 13 families of which the Lake Ontario drainage was well represented.

258. Holden, William W. 1909. Commercial fishing. Ontario Game and Fish Dept. 2nd Annual Report (1908). pp. 13-14.

This paper is a summary report of the Game and Fisheries inspectors for the year 1908. Reported is a general report on the commercial fish catch of the Great Lakes including Lake Ontario. In 1908 Lake Ontario produced twice as many whitefish as 1907, mostly from the Bay of Quinte. Herring and lake trout were plentiful as before and the sturgeon is a thing of the past. A summary of inspections of fishermen both commercial and angling is included. (Univ. of Toronto, Dept. Zoology).

259. Hooper, B. F. 1963. *Punctodora exochopora* N. sp. (Chromadoridae: Nematoda) from the Canadian shore of Lake Ontario. Canadian Journal Zoology. 41: 1121-1126.

Punctodora exochopora n. sp., collected from the Canadian shore of Lake Ontario in the vicinity of Bath, Ontario, differs from the type *P. ratzeburgensis*, in having the excretory duct projecting from the body and in having 15-16 preanal supplements. Only one to three are recorded for *P. ratzeburgensis*. *P. exochopora* differs from *P. ohridensis* by its shorter rectum (30 vs. 50 u) and having spicules with blunt distal ends. An emended generic diagnosis is given, distinguishing the genus from *Prochromadora*. *Neochromadora trilineata* Schneider, 1943 is removed from synonymy with *P. ohridensis* and is regarded as *incertae sedis*.

260. Hubbs, Carl L. 1926. A check-list of the fishes of the Great Lakes and tributary waters, with nomenclatorial notes and analytical keys. Michigan Museum Zoology. Miscellaneous publications. 15: 1-77.

A general list of the fishes of the Great Lakes and connecting waters. According to the present list, the fish fauna of the Great Lakes comprises 28 families, 96 genera and 154 species. Included in the paper are keys to families, genera and species of the fish fauna in the Great Lakes and its tributaries.

261. Hubbs, Carl L. and Dugald E. S. Brown. 1929. Materials for a distributional study of Ontario fishes. Trans. Royal Canadian Institute. 17(part 1): 1-56.

Contains a relatively complete study of the fish fauna of southern Ontario. Several drainage basins were sampled with stations 77 to 99 encompassing the Lake Ontario drainage system. A list of the species is given followed by the station number at which they were collected, their approximate age, and some remarks on identification and distribution. The list contains 96 species of which approximately 51 are reported from the Lake Ontario drainage system.

262. Hubbs, Carl L. and C. Willard Greene. 1928. Further notes on the fishes of the Great Lakes and tributary waters. Papers of the Michigan Academy Science, Arts and Letters. 8: 371-392.

This paper was prepared to call attention to new discoveries which have a bearing on the nomenclature or status of the fishes of the Great Lakes fauna. It comprises a set of additions and corrections to the senior writer's checklist (Univ. Michigan Museum Zoology, Misc. Publication No. 15). The species and subspecies of *Notropsis* which have been confused with *Notropsis deliciosus* are discussed in detail. At the end of the paper the fishes of this fauna are again listed to bring the changes in line with the published list.

The fish fauna of the Great Lakes and tributary waters comprises, according to the present list, 158 species or a total of 180 forms, subspecies included.

263. Hubbs, Carl L. and Karl F. Lagler. 1939. Keys for the identification of the fishes of the Great Lakes and tributary waters. Published by authors. Ann Arbor, Michigan. Unnumbered.

The authors have attempted to print a guide which might readily and accurately identify the fishes of the Great Lakes and tributary waters. The guide consists of a series of keys, the first to the families and the others to the genera, species and subspecies in each family. The present work presupposes on elementary knowledge of fish anatomy and of the methods used in ichthyological research. (Univ. of Toronto, Zoology Library).

264. Hubbs, Carl and Karl F. Lagler. 1941. Guide to the fishes of the Great Lakes and tributary waters. Cranbrook Institute of Science. Bulletin No. 18. 100 p.

For amateur or professional zoologists the accurate identifications of animals and a knowledge of their ranges and habitats are of prime importance. The authors have attempted to provide a means by which all persons interested may: learn the characters of importance for the identification of fresh-water fishes; "key" the Great Lakes species to their taxonomic designation; become acquainted with their known geographic range; find an ecological annotation indicating the habitat in which each forms most frequently lives. (Univ. of Toronto, Dept. Zoology).

265. Hubbs, Carl L. and Karl F. Lagler. 1964. Fishes of the Great Lakes Region. Publ. Ann Arbor, the Univ. Michigan Press, Ann Arbor, Michigan. 213 p.

The book gives a complete survey of the fishes of the Great Lakes. Included is the method of field study, identification of fishes and keys to the families, species and subspecies. Also included is a discussion on each fish family found in the Great Lakes including their physical characteristics, habitat, life cycle and food. (Canada Centre for Inland Waters).

266. Hubbs, Carl L. and T. E. B. Pope. 1937. The spread of the sea lamprey through the Great Lakes. Transactions American Fish. Society, 1936. 66: 170-176.

In the Great Lakes the sea lamprey occurred naturally only in Lake Ontario. The construction of canals has enabled this species to invade the other Great Lakes. The destructiveness of the sea lamprey has been noted in Lake Ontario and a similar problem will probably result in the remaining Great Lakes. A history of the observations and collections of the sea lamprey is discussed. It is also mentioned that there is no means currently available to control the spread of the sea lamprey.

267. Hubbs, Carl L, Boyd W. Walker and Raymond E. Johnson. 1943. Hybridization in nature between species of American cyprinodont fishes. Univ. Michigan, Contributions Lab. Vertebrate Biol. No. 23. pp. 1-21, plates 1-6.

This paper analyzes the hybridization in nature between species of fish. The discussion centers around the genera *Chriopeops*, *Lucania*, *Plancterus* and *Fundulus* combinations. The only mention of Lake Ontario was as follows "the similar mass hybridization between *Notropsis heterodon*, *Notropsis cayuga* and *Notropsis anogenus*, etc., indicated by Weed as probably occurring in Turtle Creek, Wisconsin, and in Lake Ontario, failed of confirmation when the material was re-examined."

268. Hunt, George S. 1965. The direct effects on some plants and animals of pollution in the Great Lakes. BioScience. 15(3): 181-186.

The article lists four types of pollution: chemical, including organics and inorganics; physical, including color, turbidity, temperature, radioactivity, foam and suspended matter; physiological; and biological pollution. The author includes in the article an example, using each of the above types of pollution, of how the type of pollution injured an animal or plant. For example, in Lake Ontario in 1960, 5,000 ducks were contaminated with oil, and in the Niagara River, of 195 ducks banded, 23 had oil on them and 11 which were clean at the time of banding were found dead with heavy oil on them.

269. Hunter, Alf. 1911. Untitled report to Superintendent of Game and Fisheries. Ontario Game and Fisheries Dept. 4th Annual Report, 1910. pp. 12-13.

This paper reports a summary of the findings of the game and fish inspectors. Noted was that most fishermen have obeyed regulations. Fishing has been improved over recent years in the Bay of Quinte. (Univ. of Toronto, Zoology Library).

270. Hunter, G. W. and Wanda S. Hunter. 1932. Studies on parasites of fish and of fish-eating birds. NYS Conservation Detp., Supplemental 21st Annual Rept. for 1931, Biological Survey. 6: 252-271.

During the summer of 1931 a total of 971 fish were examined to determine the parasitic fauna of the fish in the area under survey. It was necessary to include many species of fish other than game fish since the parasitic fauna of one species oftentimes affects another, i.e. larval forms of some parasites are found in one species of fish which became mature in a second species if the first host is eaten by the second.

The data on game fish is summarized and the most important points discussed. Fish-eating birds, especially the bitter, great blue heron and kingfishers were important because of their relationship to the life cycle of some of the trematodes encysted in the flesh of fish. For the same reason, snails were also examined. Included in the report is a chart on the distribution of important parasites of some of the fishes in the St. Lawrence, Oswegatchie and Black River watersheds and a description of parasites found in each major specie of fish.

Hunter, R. P. - See: C. W. Greene, No. 221.

271. Hunter, W. A. 1909. Untitled. Ontario Game and Fisheries Dept., 2nd Annual Report, 1908. p. 18.

The Game and Fishery warden of Belleville reports during the last year fishing on the whole has improved, especially commercial fishing at the Bay of Quinte. (Univ. of Toronto, Dept. Zoology).

Hunter, W. A. - See: G. W. Hunter, No. 270.

Huntsman, A. G. - See: W. J. K. Harkness, No. 230.

272. Huntsman, A. G. 1913. XX. Invertebrates other than insects and mollusks. In: Faull, J. H. (Ed.). The Natural History of the Toronto region, Ontario. Canadian Institute, Toronto, Ontario. pp. 272-286.

Contains a relatively complete list of invertebrates found in the Toronto region. The groups included are the Crustacea, Annelida, Bryozoa, Rotifers, Nematelminthes, Platyhelminthes, Coelenterata, Porifera and Protozoans. (Toronto Royal Ontario Museum).

273. Huntsman, A. G. 1915. The fresh-water malacostraca of Ontario. Contributions to Canadian Biology Fas. II Fresh Water Fish and Lake Biology. Sessional Paper No. 39b. pp. 145-163.

This paper includes information on distribution and identification of Malacostraca in Ontario. Several references are made to specimens collected from Lake Ontario.

274. Huntsman, A. G. 1917. The lampreys of Eastern Canada. Ottawa Nat. 31(2): 23-27.

The lampreys are of exceptional interest, owing to their peculiar structure and life history, as well as from the fact that they are the most primitive of vertebrates. Comparatively little is known concerning their distribution in our waters. Samples were not obtained from the drainage area of Lake Ontario, however, the author feels that due to its occurrence in the St. Lawrence River and its tributaries, it is fairly certain that it will be found in the waters of Lake Ontario. (Toronto Ontario Fish. Research Library, Zoology Library).

275. Huntsman, A. G. 1930. Attack on the fishery problem. Transactions American Fish. Society. 60: 172-177.

A brief article on the problem of how to have more fish in any certain body of water. It contains a short note about the absence of salt in the water of Lake Ontario in relation to the type of fish present.

276. Huntsman, A. G. 1937. Fish culture--Past and future. Transactions Anerican Fish. Society. 67: 87-93.

A brief note on the restoration of the Atlantic salmon in streams flowing into Lake Ontario.

277. Huntsman, A. G. 1944. Why did Ontario salmon disappear? Transactions Royal Society Canada. 3rd Series, Section 5. 38: 83-102.

The salmon of the streams tributary to Lake Ontario disappeared during the latter part of the 19th century. Included in the paper is a history of their decline, a discussion of size, rate of growth, sexual maturity, migrations, character of the better salmon streams, season of stream assent and fluctuation in abundance, and a list of the possible causes of their disappearance. The causes given are as follows: overfishing, removal of forests, more rapid drainage, clearing of the stream bed, pollution of water, silting of spawning beds and prevention of salmon assent.

278. Huntsman, A. G. and J. R. Dymond. 1940. Pacific salmon not established in Atlantic waters. Science. 91 (2367): 447-449.

The great variety of salmon of the genus Oncorhynchus in the streams of the Pacific coast has stimulated the desire to establish them in the streams of the Atlantic coast, beginning in 1872. Chinook salmon (*O. tschawytscha*) were stocked in the waters of New Brunswick and Ontario in an attempt to establish them there. The plantings were made in streams of Lake Ontario, the last in 1925, and recent inquiry reveals that the species is now unknown in these waters.

Hurlburt, W. E. - See: R. W. Sheppard, No. 511, 512.

279. Hurlburt, W. E. 1936. Blue and lesser snow geese near Vineland, Ontario. The Auk. 53: 207-208.

From October 28 - October 30, 1935 there were observed thousands of geese on Lake Ontario near Jordan. These flocks contained Blue and Lesser Snow Geese. The geese disappeared on October 30. Notes on the observations and distributions locally are included.

280. Hutchinson, G. Evelyn. 1957. A treatise on limnology. Volumn I. J. Wiley and Sons, New York City, N. Y. 176 p.

Contains a brief note on floating islands which occurred in Kingston Harbor on Lake Ontario in 1951.

281. Hyde, Sidney A. 1939. The ecology and economics of the birds along the Northern Boundary of New York State. Roosevelt Wildlife Bulletin. 7(2): 67-215.

A description of habitats and their birds including the open waters of Lake Ontario, sheltered bays, beaches, marshes and swamps along the northern boundary of New York State is presented here. Notes on the birds distribution, economic relations, ecology and an annotated list of birds on the area is included.

282. Ide, F. P. 1937. Descriptions of Eastern North American species of Baetine mayflies with particular reference to the nymphal stages. Canadian Entomology. 69: 235-243.

This excerpt presents descriptions of three genera of mayfly nymphs (Heterocloeon, Pseudoclaeon and Cloeon) found at two locations in Canada, the Credit and Ottawa Rivers. The physical character of the species are described in detail; diagrams are included. (Toronto Ontario Fish. Research Lab, Zoology Library).

283. Ide, F. P. 1954. The nymph of *Rhithrogena impersonata* (Ephemerida) and two closely related species from the same locality in Southern Ontario. Canadian Entomology. 86(8): 348-356.

Presented in this paper is information on three species of *Rhithrogena* from tributaries of Lake Ontario. Discussed are taxonomy, habitat and distribution and relationship between the species.

Inglis, Anthony - See: Croswell Henderson, No. 244.

284. International Joint Commission. 1951. Report of the International Joint Commission United States and Canada on the pollution of boundary waters. Washington, D. C. 321 p.

The areas reported include Western Lake Erie, the Niagara River and a 10 mile radius of Lake Ontario centered at the mouth of the Niagara River. Routine determinations included coliforms, biochemical oxygen demand, bacteriological examinations and plankton determinations. The analytical procedures followed were those contained in "Standard Methods for Water Analysis," 9th edition.

285. International Joint Commission. 1967. Summary report on pollution of the Niagara River. Washington, D. C. 43 p.

The report gives an up-to-date summary on the present pollution problems of the Niagara River. Although most of the pollution problems have been eliminated as far as the I.J.C. objectives are concerned, there are still a few areas in the river in which the water quality fails to meet their objectives. Problems cited in the report include high coliform counts, high concentrations of phenol, oil concentrations and odor and discoloration of the water.

286. International Joint Commission. 1969. Pollution of Lake Erie, Lake Ontario and the International Section of the St. Lawrence River. Washington, D. C. Volume 1. 150 p.

In Volume 1 the Boards have endeavored to summarize the findings and to identify the critical problems of pollution and pollution control measures which are of immediate concern to both countries, as well as those long range problems which must be brought under continuing review and study.

287. International Joint Commission. 1969. Pollution of Lake Erie, Lake Ontario and the International Section of the St. Lawrence River. Volume 3. Washington, D. C. 329 p.

The report has been prepared in three volumes. Volume 3 contains the scientific and engineering data and findings which have been used to determine the sources and levels of pollution in Lake ontario, as well as recommendations for the necessary remedial measures. The report combines a historical review of aquatic biological data with the results of more recent surveys conducted by the FWPCA and OWRC.

288. International Joint Commission. 1970. Pollution of Lake Erie, Lake Ontario and the International Section of the St. Lawrence River. Washington, D. C. 174 p.

This report represents the culmination of work by the I.J.C. on the inquiry into the extent, causes and locations of pollution in Lakes Erie and Ontario and the International Section of the St. Lawrence River.

Pollution and enrichment have changed the biological communities of Lake Ontario. The cecedophora and phytoplankton problems are mentioned. The changes in the benthos and fish populations and factors contributing to it are discussed. Accumulation of mercury, DDT and organic chemical levels are of interest and are discussed.

Bacterial contamination from the Niagara River and contrast between shore and off shore lake waters are discussed. The effect of increases in algae and bacteria in relation to humans is mentioned along with the effect oils, DDT, mercury and other pollutants have on wildlife in Lake Ontario.

General and specific objectives for remedy of these problems in relation to the biota of the lake are made. Recommendations and conclusions are included.

289. International Joint Commission Lake Erie-Lake Ontario Advisory Board, 1971. Summary Report on Pollution Abatement. Progress in the Niagara River Area. Washington, D. C. 61 p.

This paper is a summary of the pollution abatement progress in the Niagara area that has occurred since 1967. The objectives of the abatement concerning microbiology was that the total coliform count of local waters shall not exceed 1000/100 ml and that fecal coliform shall not exceed 200/100 ml. Waters to be used for recreation should be free from bacteria, fungi and viruses that may produce enteric disorders, or eye, ear, nose, throat and skin infections.

Data collected since 1967 shows that the bacteriological quality of the Niagara River is approximately the same as it was in 1967. This is expected as corrective measures have not been completed. Studies show that the U. S. waters within 1000 feet of shore in the upper River are ranging between 1000 and 5000/100 ml. The Canadian shore was significantly lower. The lower Niagara River has counts averaging 1000-3000/100 ml and there is very little difference between Canadian and U. S. waters.

The bentak biology of the Niagara River was also considered. The community in the U. S. waters are primarily pollution tollerant organisms and the Canadian waters having primarily pollution sensitive organisms.

290. Jackson, Daniel F. 1966. Photosynthetic rates of *Cladophora fracta* from two sites in Lake Ontario under natural and laboratory conditions. Univ. of Michigan, Great Lakes Research Division. Proceedings 9th Conference Great Lakes Research. Pub. 15: 44-50.

Photosynthetic and respiration rates of *Cladophora fracta* were measured under natural conditions in Lake Ontario at Oswego, New York, and in Henderson Bay during the months of June-July and September-October, 1965. The average photosynthetic rate for the early summer months for Lake Ontario at Oswego was 2.63 while that of Henderson Bay was 2.35 ul O_2/hr/mg ash-free dry wt. The fall months average was 1.27 for Oswego and 0.50 ul O_2/hr/mg ash-free dry wt. for the Henderson Bay area. Respiration rates were slightly higher in Henderson Bay, both in the early summer and in the fall.

Cladophora samples to which specific quantities of the radio-nuclide P_{32} were added showed only a slight average increase in photosynthetic activity in samples collected in June and July from the Oswego site (0.17 ul O_2/hr/mg ash-free dry wt.). *Cladophora* samples collected in September and October and treated with P_{32} had an average increase of 1.04 ul O_2/hr/mg ash-free dry wt.

291. Jackson, Daniel F. 1967. A study of the periphytic organisms of the eastern end of Lake Ontario. Proceedings 10th Conference Great Lakes Research. pp. 31-36.

Four different locations along the shoreline of the eastern section of Lake Ontario in New York State were selected to study the qualitative and quantitative composition of the attached and associated free living forms of algae. The study period was between May 1 and November 1, 1966. Analyses of the periphyton communities were made from organisms harvested from plexiglass plates suspended at eight different depths at each station.

The average biomass of a 3.6 m vertical water column in eastern Lake Ontario, from 1,920 determinations, yielded 78.3 mg ash-free dry wt./sq. dm. The average maximum quantity of biomass measured at all stations occurred in June. Zoospores and germlings of *Cladophora* were abundant on all slides collected in the plexiglass plates consisted of 35 genera.

292. Jackson, Daniel F. 1967. Lake Ontario and the St. Lawrence River - What are their fates? Presented to the Cape Vincent Chamber of Commerce and the Cape Vincent Village Board. (Mimeo) Unnumbered.

A discussion of the algae problem in Lake Ontario and the changes in the commercial fishing in Lake Ontario from 1952 to 1962. The paper is geared toward the recreational aspects of Lake Ontario. (Rochester-EPA).

293. Jackson, Daniel F., Nelson L. Nemerow and Myrton C. Rand. 1964. Ecological investigations of the Oswego River drainage basin. I. The Outlet. Univ. of Michigan, Great Lakes Research Division. Proceedings 7th Conference Great Lakes Research. Pub. 11: 88-99.

The Oswego River drainage, 5121 square miles, is the largest drainage area of the eastern part of Lake Ontario. In order to ascertain its effect on the lake, a series of sampling stations has been established at 10 different sties along contributing streams. This report represents the results obtained at Station 1, the outlet of the Oswego River into Lake Ontario, from January 10 through March 6, 1964. Weekly average values for phosphates were 3.31 mg/l, total Kjeldahl nitrogen, 2.06 mg/l; alkylbenzenesulphonate, 0.16 mg/l. The average weekly pH value was 7.2 while the water temperature averaged 3°C, with a flow of 7.257 cfs. The average coliform count was 14,178 per 100 ml, the average weekly total phytoplankton value was 1,190 organisms per ml, while the zooplankton population, which consisted almost entirely of rotifers, averaged 4.4 per liter. The periphyton community consisted of 55 species representing 28 genera. The weekly average number of algal species growing on bricks in the river was 25. These had a volatile weight of 4.2 mg/l and consisted of $913/cm^2$. The pollution load of the Oswego River was evaluated from information obtained through this study.

James, M. C. - See: Glen C. Leach, No. 327.

294. Jennings, H. S. 1899. Rotatoria of the United States, with especial reference to those of the Great Lakes. Bulletin of the U. S. Fish Commission. 19: 67-104.

Notes observation in the Niagara River by Kellicott of *Floscularia millsii* in 1884 and *Limnas ceratrophylli* in 1896, as well as by Mills of *Megalotrocha alboflavicans* in 1881 and *Anuraca cochlearis* in 1882.

Jermolajev, E. G. - See: Daniel J. Faber, No. 158.

295. Johnson, B. G. H. 1968. Biological data on see lampreys in the Humber River, Lake Ontario, 1968: In: Great Lakes Fishery Commission Report of Annual Meeting, (Unpublished). Appendix 3: 10-11.

During the period of April to September 1968, approximately 1,200 spawning-phase sea lampreys were caught in the Humber River, a tributary of Lake Ontario. The most successful fishing period was in mid-May, and the run was over, for practical purposes, by the end of July. Sea lampreys captured to the end of July were sexually mature and most were judged ready to spawn.

Included is a chart containing the sex-ratios, lengths and weights of male and female sea lamprey collected from the Humber River.

296. Johnson, B. G. H. 1969. Some statistics of the populations of parasitic phase sea lampreys in Canadian waters of the Great Lakes. Proceedings 12th Conference Great Lakes Research. pp. 45-52.

Parasitic-phase sea lampreys, taken in commercial fishing gear, were collected from Great Lakes fishermen with records of the place, data and manner of capture. The catch of sea lampreys per unit of effort was lower in the North Channel then in Lake Huron proper or Georgian Bay, both in 1967 and in 1968, on early indications of the success of sea lamprey control measures recently undertaken in the North Channel. The proportions of male to female sea lampreys taken in the commercial fishery declined markedly in the fall in all areas sampled. Segregation of the sexes could bias those estimates of sea lamprey abundance that are based on evidence of their numbers in the commercial fishery. Rate of growth in length is nearly linear during the fishing season, but a consistent size difference exists between the sea lamprey attached to certain different host fishes.

297. Johnson, B. G. H. and R. B. Perkins. 1968. Biological data on sea lampreys collected by commercial fishermen from Great Lakes waters - 1968. In: Great Lakes Fishery Commission Report of Annual Meetings, (Unpublished). Appendix 4: 12-16.

During 1968, commercial fishermen in the Great Lakes area submitted 1,962 sea lampreys with related catch data, in response to the reward offered by this station. Laboratory examination for length, weight, sex, maturity and stomach content has been completed for 1,127 specimens, 695 from the Lake Huron main basin, 81 from North Channel, 211 from Georgian Bay, 137 from Lake Ontario and 3 from Lake Superior.

Included are charts on lengths, sex ratios and lake where lamprey was caught. (Canada Centre for Inland Waters).

298. Johnson, M. G. and D. H. Matheson. 1968. Macroinvertebrate communities of the sediments of Hamilton Bay and adjacent Lake Ontario. Limnology and Oceanography. 13(1): 99-111.

The distribution and abundance of benthic macroinvertebrates in Hamilton Bay and adjacent Lake Ontario were related to physical and chemical characteristics of the water and sediments and to hydrodynamic factors. The profundal sediments of Hamilton Bay, rich in organic matter, contained an abundance of *Limnodrilus hoffmeisteri* and *Tubifex tubifex*, while lesser numbers of five Limnodrilus species occupied poorer sublittoral sediments. No macroinvertebrate community occurred in sediments containing more than 25% Fe_2O_3. The combination of more favorable water chemistry, circulation, and moderately rich sediments near the canal connecting the bay with Lake Ontario increased biomass of oligochaetes over that in the richer, profundal sediments of the main basin of the bay. In Lake Ontario the oligochaetes, *L. hoffmeisteri*, *T. tubifex* and *Stylodribes heringionus* and the amphipod, Pontoporeia affinia increased in numbers with increasing depth and richness of sediments. Emissions of bay water to Lake Ontario clearly influenced the specific composition of macroinvertebrate communities. The community of several oligochaetes and Chironomum attenuatus found in the lake near the canal resembled the sublittoral bay community. *T. tubifex* occurred in the lake only in the plume of rich sediments projected into the lake from the canal, while Sphaeriid populations were more abundant and contained more species in the sandy or loamy sediments outside the plume.

299. Johnson, M. G. and D. S. Osmond. 1969. Benthic macroinvertebrates of the Great Lakes - A list of recorded species and their distribution. Great Lakes Institute, Univ. Toronto. Appendix 6(3): 70-86.

This paper presents a list of benthic macroinvertebrate species by Lake. A total of 85 accounts published between 1872 and 1968 were examined in the preparation of this list. (Canada Centre for Inland Waters).

300. Johnson, M. G. and G. E. Owen. 1970. The role of nutrients and their budgets in the Bay of Quinte, Lake Ontario. Ontario Water Resources Commission, Toronto, Ontario. 24 p.

The Bay of Quinte shows symptoms of cultural eutrophication which are markedly similar to those of Lake Erie. Algal blooms are severe and prolonged, and macroinvertebrate and fish communities are composed of pollution-tolerant species. The effects of excess nutrients on algae, some invertebrates and fish is discussed.

301. Johnson, M. G. and G. E. Owen. 1971. Nutrients and nutrient budgets in the Bay of Quinte, Lake Ontario. Journal Water Pollution Control Federation. 43(5): 836-853.

Among the symptoms of so-called cultural eutrophication, which sums the variety of human activities contributing to excessive enrichment of lake waters, are nuisance blooms of algae, increased turbidity, depletion of deep-water oxygen and changes in the composition of communities of algae, invertebrates and fish. These symptoms are increasingly obvious in the Bay of Quinte of Lake Ontario, which is unfortunate because this bay is one of the finest natural features of the St. Lawrence Great Lakes.

The purpose of this paper is to describe the severity of these symptoms, to associate these with the increased human activity on the Bay of Quinte which has led to increased input of nutrients, to clarify the respective significance of contributions from tributary rivers and from municipal-industrial sources.

Johnson, Raymond E. - See: Carl L. Hubbs, No. 267.

Johnson, Wendell L. - See: Croswell Henderson, No. 244.

302. Jordan, David S. 1884. The lesser white-fishes. In: Goode, George Brown (ed.). The Fishery Industries of the United States. U. S. Commission Fish and Fisheries. Section III, Part Q(169): 541-543.

The article discusses the least important white-fishes. The cisco is mentioned as being the smallest white-fish, rarely weighing over half a pound and being found in Lakes Michigan, Erie and Ontario.

303. Jordan, David S. and B. W. Everman. 1909. A review of the salmonoid fishes of the Great Lakes, with notes on the whitefishes of other regimes. Bulletin U.S. Bureau Fish. 29: 55.

In the investigations of the fisheries of the Great Lakes region conducted in 1908 and 1909 by the International Fisheries Commission, the writers had an opportunity to examine great numbers of specimens of the food fishes and especially of the Coregoninae, known as whitefish and lake herrings. It has been clearly shown that the fauna of each of the Great Lakes exhibits pecularities of its own, and especially that each lake has one or more species of the group called lake herrings or ciscoes peculiar to itself. In this paper, the species of these and other groups of freshwater Salmonidae are treated and figured somewhat fully. The following species are described as new: *Leucichthys supernas*, *Leucichthys cyanoptereis*, *Leucichthys manitoulinus*, *Leucichthys ontariensis* and *Leucichthys harengus arcturus*.

304. Jordan, David S. and William Francis Thompson. 1911. Description of a new species of deep-water sculpin (*Triglopsis ontariensis*) from Lake Ontario with notes on related species. Proceedings U. S. National Museum. 38(1728): 75-78.

This paper notes the occurrence of a sculpin from deep water off Toronto, belonging to the genus *Triglopsis* Girard, the freshwater representative of a marine genus *Oncocottus*. A complete description is given followed by comparison of *Triglopsis ontariensis* (Lake Ontario off Toronto) with *T. stimpsoni* (Lake Michigan off Chicago) and *T. thompsoni* (Lake Ontario off Oswego).

Triglopsis thompsoni and *Cottus ricei* (a little known deep water sculpin) were both found upon examination of stomachs of predatory ling (*Lota maculosa*) off Oswego.

305. Judd, W. W. 1948. A study of the population of insects emerging as adults from the Dundas Marsh, Hamilton, Ontario, during 1948. American Midland Naturalist. 49(3): 801-824.

The first recorded studies of insects from the Dundas Marsh concern the phalaenoid moths, *Aiyama obliquata* and *A. diffusa*, whose larvae drill in the leaves of aquatic plants. Moffat (1888, 1888a) reported collecting *A. obliquata* from reeds and stumps in the vicinity of the marsh and Johnson (1889) recorded the occurrence of both of these species in his collections. Moffat (1889) also reported collecting *A. obliquata* and *Nonagria fodians* from a cat-tail, *Typha sp.* In 1946, a few species of insects were collected about the marsh and in 1947 a project was undertaken to determine the times of first and last emergence and the period of maximum emergence of various species which emerge as adults from the water. These studies are discussed by Judd (1947, 1949, 1949a, 1950a). In 1948, a study was made of pysulation of insects emerging from the marsh from March to November, the present paper being a report on this project.

Between March 16 and November 20, 1948, 15,338 adult insects emerging from the waters of the Dundas Marsh were trapped in 5 cages, representing an average emergence of 409 insects per square foot during the period. The orders represented were Ephemergstera (9.9%), Odonato (1.5%), Trichoptera (0.5%), Lepidoptera (0.9%), Diptera (87.1%) and Hymenoptera (0.1%). Midges of the family Tendipedilae (Chirmomidae) constituted 92.5% of the Diptera.

306. Judd, W. W. 1950. Plants collected in the Dundas Marsh, Hamilton, Ontario., 1946. Canadian Field Naturalist. 64(4): 127-130.

Contains a list of plants collected in the Dundas Marsh, Hamilton in the summer of 1946 in the course of an ecological survey of the region. The list encompasses the Hepaticae, Pteridophyta and Spermatophyta represented by 39 families from the Typhaceae through the Compositae.

Jurkovic, Arnold - See: Allan Bruce, No. 79.

Jurkovic, Arnold - See: A. S. Menon, No. 364.

307. Kellicott, D. S. 1878. Notes on microscopic life in Buffalo water supply. American Journal Microscopy and Popular Science. 3: 250-252.

This paper includes notes on early microscopic observation of microorganisms from the Buffalo water supply which at the time was unfiltered Niagara River water.

It was noted that in the spring and fall that large populations of the diatom *Melosira varians* load up the water. Also noted was that green algae, crusteans, hydras and annelids were discovered. Some relationships between these organisms and those found in the Niagara River are noted.

Kendall, William C. - See: Barton Warren Evermann,
No. 157

308. Kendall, William C. 1921. The relationship of the so-called blue pike and yellow pike of Lake Erie and Lake Ontario. Transactions American Fish. Society, 1920. 50: 257-267.

The relationship of the yellow pike to the blue pike concerning permanent structural differences was compared. Twenty specimens of each form representing Lake Erie and Lake Ontario were examined and compared for differences. Several taxonomic distinctions were noted included differences in color of scales and fins; differences in number of teeth. It was concluded that the blue pike is not an immature yellow pike but are mature fish and should be considered distinct species. More study of the blue pike is advised concerning life history and distribution.

309. Kendall, William C. 1924. The status of fish culture in our inland public waters, and the role of investigation in the maintenance of fish resources. Roosevelt Wildlife Bulletin. 2(3): 205-351.

The sections covered in this paper are as follows: the condition of inland fisheries - original and present, fishery investigations and surveys in New York State, general principles of stocking inland waters, propagation and distribution of fish by New York State and regulations for protecting fisheries.

Mention is made that salmon used to occur in Lake Ontario and frequent New York and Ontario streams for spawning. Mention is also made of the occurrence of herring in Lake Ontario.

310. Kennedy, W. A. 1936. *Pomoxis annularis* in Ontario. Copeia. No. 2: 121.

Contains a brief note on the occurrence of *Pomoxis annularis* in Lake Ontario at Burlington Bay and Jordan Harbour.

311. Kennedy, W. A. 1956. Current fisheries research by Canadians on the Great Lakes. Transactions American Fish. Society. 86: 419-423.

The various activities are reviewed and they fall into two categories: 1. a contribution towards eliminating sea lamprey from the Great Lakes, and 2. some general fishery research.

With reference to Lake Ontario, an experiment to determine the effectiveness of planting whitefish fry as a management technique is almost completed. The data so far collected tend to show that plantings do not influence year-class strength appreciably.

The group on Lake Ontario is also cooperating with New York State investigators in an experiment to determine whether the planting of lake trout fingerlings is likely to be an effective way to rehabilitate the trout populations of the lake. The experiment is incomplete but examination of small lake trout indicates that the planted fish are contributing significantly to the oncoming year classes.

312. Kennedy, W. A. 1957. Current fisheries research by Canadians on the Great Lakes. Studies from the Stations of the Fisheries Research Board of Canada. FRB No. 495.

The activities described in this report include: A contribution towards eliminating sea lamprey from the Great Lakes; and some general fishery research. Research on Lake Ontario include a whitefish management program and a lake trout rehabilitation program. (Canada Centre for Inland Waters).

313. Kerr, John W. 1874. Notes relative to the whitefish. Report U. S. Fish Commission, Fresh Water Fisheries of U. S. (1872-73). Washington, D. C. pp. 81.

Presented in this short note is a comparison of whitefish between Lakes Erie and Ontario concerning taste and dimensions of the fish.

314. Kiel, Peter. 1874. The white-fish of the Great Lakes. 2. Lakes Erie and Ontario. U. S. Commission Fish and Fisheries, Report for 1872-1873. Part 2: 81-84.

Contains notes on the habits and varieties of some specimens of whitefish taken in Lake Ontario.

315. Kindle, E. M. 1925. The bottom deposits of Lake Ontario. Transactions Royal Society Canada, 3rd Series. 19 (4): 47-102.

Included in this paper is a discussion of the organic features of the bottom deposits in Lake Ontario. The plant zones begin with the cat-tails which give way to the bullrushes (depth 4-5'), then to the pond weeds (depth6-15') and finally to the diatom and algal flora (depth up to 150') of which *Cladophora* is quite common. At depths below 200' there doesn't seem to be any plant life.

The discussion of plant zones is followed by a discussion of faunal zones. The extent to which the distribution of different groups or invertebrates depends upon depth of water is shown in a table. As can be seen from the table, the invertebrates range from approximately 1 to 450' with the greatest abundance in the shallower zones.

316. Kingsbury, John. 1968. Review of the algal literature for New York State. In: D. F. Jackson (ed.). - Algae, Man and the Environment. Syracuse Univ. Press, Syracuse, N. Y. pp. 525-541.

New York State is unique among states in its aquatic resources. It is the only state having an open shoreline on both the Great Lakes and the Atlantic Ocean. With Michigan alone, it borders on more than one Great Lake. The central part of the state is dominated by the Finger Lakes, of unusual depth, and Oneida Lake, of nearly opposite characteristics. Fayetteville Green Lake presents a textbook example of chemical stratification. Pristine mountain lakes of the Adirondacks in the east contrast with eutrophic Chautauqua Lake at the western end of the state. Cayuga Lake grows *Cladophora* balls that are as large as any reported in the world.

Limnoligical investigations of the waters of New York State have been comprehensively reviewed. This essay, therefore, emphasizes investigations relating particularly to algae. Included in the essay is water supply investigations from 1860-1905 and New York State biological survey which occurred in 1927-1940.

317. Kinney, W. L. 1971. The macrobenthos of Lake Ontario. Abstract of paper presented at the 14th Conference Great Lakes Research, Toronto, Ontario, April 19-21, 1971. pp. 111-112.

The distribution and abundance of the macrobenthos of Lake Ontario and selected adjacent bays, harbors, river mouths and inshore sites were investigated during the past four years in an effort to relate macroinvertebrate benthic ecology to water quality.

Lake Ontario bottom faunal data indicate that organic pollution influences the composition of the macrobenthic communities in nearshore environments.

318. Kleerekoper, H., Grace Taylor and R. Wilton. 1961. Diurnal periodicity in the activity of *Petronuyzon marinum* and the effects of chemical stimulation. Transactions American Fish. Society. 90(1): 73-78.

Specimens of the parasitic stage of *Petromyzon marinus* were obtained from Lake Ontario and Lake Huron. Larval forms were captured in the general region of Hammond Bay, Lake Michigan.

Both the transforming ammocoete and parasitic lamprey display an enclogenous cyclic activity rhythm. The rhythm is gradually lost in constant conditions of dim light but is re-established by exposing the animal to one to two artificial diurnal light cycles. Rhythm in the parasite can also be re-established by exposing the animal during a single short period to chemical sensory stimulation produced by the scent of fish. Diurnal rhythm so established was maintained during a period of 5 days at the end of which observations ceased. Sensory stimulation can function as a "setting" mechanism of the physiological clock. In this instance, the setting mechanism is not related to the metabolism of the animal but must have its seat in the central nervous system.

319. Koelz, Walter. 1924. Two new species of cisco from the Great Lakes. Univ. Michigan, Museum Zoology. Occasional Papaer. 146: 1-8.

The paper describes two new species of Ciscoe, including physical characteristics and distribution.

320. Koelz, Walter. 1926. Fishing industry of the Great Lakes. Dept. of Commerce, U. S. Bureau Fisheries Document No. 1001. pp. 601-609.

This report gives a general description of the physical characteristics of the lake, as well as a history, present status methods and apparatus of the fishing industry of the lake. Principal species of the commercial fisheries, other indigenous species and introduced species are listed along with their distribution and the method of capture. The fishing regulations for commercial fishermen and sport fishermen are also included. (Univ. of Toronto, Zoology Dept.).

321. Koelz, Walter. 1927. The necessity for scientific investigation of the commercial and game fish of the province of Ontario. Paper presented at the Divisional Conference for Biological Inquiries, Washington, D. C. (January 4-7, 1927). 11 p.

The address contains a general description of the commercial and game fisheries and their values of the years 1924-1926. A comparison is given of the size in pounds of the total annual commercial yield of the fisheries of the 5 great Lakes. The authors cites the severe depletion of the herring fishery in Lake Erie and warns of the continued depletion of choice commercial and the less desirable fishes. Although there are nine governments administering some form of legislation, none of this is coordinated, therefore, little is accomplished in remedying the plight of the commercial fisheries.

The author cites the problem at hand: to maintain a supply of the commercially utilized fish and increase methods which help eliminate serious competitors of the commercial and game fishes.

Kossiakina, E. G. - See: Daniel J. Faber, No. 158.

322. Kumlien Ludwig. 1887. The fisheries of the Great Lakes. Fisheries and fishery industries of the U. S., Section 5. 1: 755-769.

Presented here is a discussion of the fish catching apparatus used in the Great Lakes around 1887. The pound net industry was the most important in the Lakes but the Lake Ontario pound net fisheries was considered minor with only a few stations near Sackett's Harbor and Cape Vincent. The apparatus and methods of fishery are discussed. The gill net fishery is the second most important but Lake Ontario is still of less importance than the rest of the lakes. Grounds of limited extent exist in the vicinity of Paultneyville, Fair Haven, Oak Orchard, Wilson, Braddocks Bay, Charlotte and Colise Landing. The fishermen, apparatus and methods of fishery are included. The seine fishery is also presented with a discussion of the methods and apparatus of its use. It is mentioned that seining is quite important around Port Ontario in Lake Ontario. Some minor fishery methods such as nets and spawning are mentioned.

Lachner, Ernest A. - See: Edward C. Raney, No. 481.

Lagler, Karl F. - See: Carl L. Hubbs, No. 263, 264, 265.

323. Lapworth, E. D. 1956. The effect of fry plantings on whitefish production in Eastern Lake Ontario. Journal Fisheries Research Board Canada. 13(4): 547-558.

Whitefish fry were planted in the Bay of Quinte and adjacent waters in numbers varying from 208 millions in 1927 to none in 1945. Since 50% of the commercial whitefish catch from these waters consisted of five-year-old fish, whitefish production in each of the years from 1929 to 1951 was compared to the number of fry planted 5 years previously (1924-1946). No correlation could be found between the number of fry planted and the production of whitefish 5 years later. The largest number of fry planted (208 million in 1927) was followed by the lowest production of the entire period (95 thousand pounds in 1932). On the other hand, following no planting in 1945, production in 1950 was approximately normal (162 thousand pounds).

The age composition of the commercial catch in the years 1944-1951 was determined from scale samples. By applying the age composition to the total catches in these years, the contributions of the year-classes 1940-1945 have been estimated. The number of fry planted probably did not affect the contribution of these year-classes to the fishery.

324. LaRocque, Aurele. 1953. Catalogue of the recent molluska of Canada. National Museum of Canada Bulletin No. 129. 406 p.

The purpose of the catalogue is to give a list of the Mollusca found in Canada or in the seas off its coast, together with the following information on each species: (1) a reference to the original description, (2) other references in which further data on the species may be found, (3) its type locality, (4) its exact range, so far as known. Listed are the mollusks found in Lake Ontario. (Univ. of Toronto, Zoology Library).

325. Lawrence, W. Mason. 1955. The Great Lakes fisheries. New York State Conservationist. 9(3): 12-13.

The paper discusses the events which lead up to the formation of a Great Lakes Fishery treaty signed by the United States and Canada. The treaty provides for joint action by the U. S. and Canada in fishery research and in control of the sea lamprey in the Great Lakes. To carry out this work both governments agree to establish a Great Lakes Fishery Commission. It is hopen that research will point the way to greater sustained production of lake trout, blue pike and perch, which would obviously be of benefit to both sport and commercial fishermen.

326. Lawrie, A. H. 1970. The sea lamprey in the Great Lakes. Transactions American Fish. Society. 99: 766-775.

This paper pertains basically to the problems that the establishment of the sea lamprey has had on Lake Erie and upper Great Lakes, its controls measures and effectiveness of control. Mention is made of Lake Ontario as being the source of the original sea lampreys to the upper Great Lakes via the Welland Canal.

327. Leach, Glen C., M. C. James and E. J. Douglass. 1941. Propagation and distribution of food fishes, fiscal year 1940. U. S. Dept. Interior, Bureau Fish., Report Commissioner Fish. for 1940. Appendix 4: 555-603.

In the section on Great Lakes species, reference to Lake Ontario was made as follows: A total of 6,335,000 whitefish eggs were received from local fishermen and the resultant fry were planted in Lake Ontario. The lake-herring eggs secured from commercial fishermen were few and of poor quality, but such as were obtained were released in Lake Ontario.

328. Leach, John F. 1962. Summer food and feeding of the white perch, *Roccus americanus* (Gemlin) in the Bay of Quinte. Univ. Toronto, Dept. Zoology. Masters thesis. 58 p.

Since the white perch has invaded Lake Ontario and subsequently the Bay of Quinte, the numbers of the species have rapidly increased creating several problems including the effect that this species might have on existing fauna of the Bay. It is possible, that white perch may prey on or compete for food with other of the Bay species. It is evident that basic information on the life history and ecology of this species in these waters would facilitate an understanding of this problem. Consequently, a preliminary study of the summer food and feeding of the white perch in the Bay of Quinte. (Toronto Ontario Fish. Research Library, Zoology Library).

329. Letson, Elizabeth. 1905. Checklist of the molluska of New York. New York State Museum Bulletin 88: 1-112.

A list of species of mollusks in New York State with reference to distribution within the state.

330. Letson, Elizabeth. 1909. A partial list of the shells found in Erie and Niagara Counties and the Niagara Frontier. Bulletin Buffalo Society Natural Sciences. 9(2): 239-245.

Contained in the paper is a list of shells encompassing approximately 152 species found in Erie and Niagara counties, and the Niagara Frontier. Of those 152 species, 41 were reported from the Niagara River and 1 was mentioned from Lake Ontario.

331. Lewis, C. E. 1886. Swans in the Niagara River. Forest and Stream. 26: 167.

Contains a brief note on the occurrence of ten swans swimming in the Niagara River below the Falls and the capture of one of the birds.

332. Lewis, C. F. M. and R. N. McNeely. 1967. Survey of Lake Ontario bottom deposits. Proceedings 10th Conference Great Lakes Research. pp. 133-142.

Short gravity cores and grab samples, recovered during a continuing reconnaissance survey initiated in 1966, were used to study the distribution, stratigraph and chronology of Lake Ontario bottom deposits. Three major groups of surficial deposits were recognized: complex near shore sediments; glaciolacustrine clays; post-glacial muds. Organic contents of 2 to 6% and median particle diameters of 1 to 4 microns are typical of the offshore surficial muds. Pollen in these sediments facilitates correlation and subdivision and indicated that the present sedimentation rate in the main basin is approximately 10 cm per century. Several sediment sequences confirm the post-glacial low-level Admirality Lake stage and suggest it may have reached lower levels than previously believed.

333. Loftus, K. H. 1950. The sea lamprey in Ontario. Sylva. 6(3): 25-35.

Contains a general description and natural history of the sea lamprey and a discussion of its spread from Lake Ontario where a landlocked form was known to occur to its invasion of the upper Great Lakes. Possible methods of control and their disadvantages are also discussed. (Univ. Toronto Main Library).

334. Loftus, K. H. 1959. Ontario-New York Conference. Minutes of Meeting, April 9-10, 1959, Watertown, New York. 9 p. (Unpublished).

The various sections, all of which are very brief, of the conference which mention Lake Ontario are as follows: 6-lake trout studies; 10-whitefish; 11-American eel; 12-general status of commercial fishery; 13-yellow pickerel; 14-smallmouth bass; 15-salmon; 18-prospectus for Lake Ontario research; and 19-relationship of committee to commission. (Univ. of Toronto, Zoology Library).

335. Ludwig, James Pinson. 1965. Biology and structure of the Caspian tern (*Hydroprogne caspia*) population of the Great Lakes from 1896-1964. Bird Banding. 36(4): 217-233.

This paper deals primarily with an analysis of 370 recoveries of CAspians banded as chicks in the Great Lakes' colonies. Data gathered between 1959 and 1964 on population, size, nesting, food habits and endoparasites are also presented. Data on population and nesting was gathered by counting nests, dead chicks, etc, or by standard census procedures. Maps show recovery on the Niagara River and Lake Ontario for only juvenile Caspian terns age 0-6 months. (Toronto-Royal Ontario Museum).

336. Ludwig, James Pinson. 1966. Herring and ring-billed gull populations of the Great Lakes, 1960-1965. Univ. of Michigan, Great Lakes Research Division. Proceedings 9th Conference Great Lakes Research. Pub. 15: 80-89.

The gull populations of the Great Lakes have increased enormously in the last decade. During this 6-year study, herring gulls (*Larus argentatus*) increased from 24,000 to 43,000 breeding pairs in Lakes Huron and Michigan, and ringbilled gulls (*Larus delawarensis*) increased from 27,000 to 99,000 breeding pairs. Apparently, herring gulls of Lakes Huron and Michigan have produced the birds which are nesting there on their own, but ring-billed gulls have, in addition to raising more gulls in the Lakes Huron and Michigan colonies, recruited many adult gulls from Lake Ontario. The Lake Ontario ring-billed population exceeds 100,000 breeding pairs. Both of these populations fit models which have a 10 or 12% annual adult mortality and 60 to 70% loss of fledglings prior to first breeding. Similar population growth was noted in the caspian tern (*Hydroprogne caspia*). Alewives (*Alosa pseudoharengus*) made up 50 to 85% of these birds' diets while residents on Lakes Huron and Michigan. Apparently, this new food resource has provided the gulls with more food when needed to raise young and thus underpinned these populations' growth. Factors threatening these growing gull populations include a shortage of nesting space, pesticides in the food chain and botulism. Increasing gull populations seem to be providing, with no increase in death rate, many more gull carcasses on the beaches. Clearly, the gull dieoffs are much more complex than owing to a single cause, botulism. As yet, these dieoffs have had little effect on the populations.

337. Ludwig, James Pinson. 1969. Great Lakes gulls. Limnos. 2(1): 3-11.

The population levels of gulls in the Great Lakes has recently been increasing. It is thought that the increase may be due to the recent increases in the alewives in the Great Lakes resulting in a much larger food supply. Information on identifying characteristic migration patterns, life histories and species distribution is presented. The effect on gulls of adverse environmental factors such as storms, pesticides and botulism are discussed. Lake Ontario has large populations of gulls with about 400,000 ring-bill gulls nesting there each year.

338. MacKay, H. H. 1925. An estimate of the efficiency of a three inch gill net as compared with a two and one-half inch gill net in herring fishing in Lake Ontario. Univ. of Toronto, Dept. Zoology. 7 p. (Unpublished).

This report embodies the results of an investigation carried out under the direction of the Department of Game and Fisheries in an effort to determine the efficiency of a three inch gill net in herring fishing, in Lake Ontario. The comparison was made chiefly on the basis of weight, the minimal weight of herring considered as legal, being eight ounces.

The percentage number of herring above legal weight was much higher in the case of the three inch nets, disregarding the occurrence of *L. hoyi*. (Univ. of Toronto, Zoology Library).

339. MacKay, H. H. 1930. Pollution problems in Ontario. Transactions American Fish. Society. 60: 297-305.

Although the waters of Ontario are not subjected to the same degree of pollution as those of the more industrialized industrialization of the cities and towns of Ontario, the problem of disposal of trade waste is one which calls for more than an ordinary amount of vigilance if we are to preserve fish, and the life on which fish depend, from its destructive effects.

The paper deals with the intensive studies done by the Fish Culture Branch of the Ontario Department of Game and Fisheries of suspected pollution situations in the waterways of Ontario. In the studies standardized field methods were used in order to leave the way open for legitimate comparisons. The preliminary studies have been carried out in the following centres of suspected pollution: Sarnia, Chatham, Bridgeport, Burlington Bay, Bridgeburg, Lindsay, Peterborough, Bauch, Midland, Huntsville, Sturgeon Falls, Temiskaning, Haileybury, Timmins, Iroquois Falls, Smooth Rock Falls, Kapuskaing, Sault Ste. Marie and Kenna.

340. MacKay, H. H. 1934. Record of the alewife from Lake Huron. Copeia. No. 2: 97.

Contains a brief note on the occurrence of *Pomolobus pseudo-harengus* (Wilson) from Lake Huron with reference to the abundance of this species in Lake Ontario.

341. MacKay, H. H. 1956. The spring salmon (with notes on two other species, the chum salmon and the pink salmon). Sylva. 12(6): 25-33.

The article discusses the various aspects of the spring salmon including distribution, habitat, habits and game qualities. The distribution, habits and economic value of the chum and pink salmon are also discussed.

Included are notes on the occurrence of the spring salmon in Lake Ontario. Also plantings of the spring salmon from the Newcastle Hatchery, Ontario into Lake Ontario and some of its tributaries for the years 1875-1882 and 1919-1925 are presented in tabular form. (Univ. of Toronto, Main Library).

342. MacKay, H. H. 1963. Fishes of Ontario. Ontario Dept. of Lands and Forests. Toronto, Ontario. 300 p.

Each area of the earth's surface has its own collection of animals, including its fishes. When the fish life of one geographical area differs from that of another, an account of the fishes of the area and of the conditions required for their success is necessary before management principles can be successfully applied. The purpose of this publication is to present such information for the Province of Ontario.

The main body of this book consists of detailed descriptions of most of the important and common kinds of fishes found in the Province, including those of special interest to sportsmen because of their gameness, as well as those of considerable commercial value. (Ontario Dept. Lands and Forests Maple).

MacGillwary, E. - See: H. H. MacKay, No. 343.

343. MacKay, H. H. and Earl MacGillwary. 1946. Recent investigations on the sea lamprey (*Petromyzon marinus*) in Ontario. Transactions American Fish. Society. 76: 148-159.

A brief history of the movement of the sea lamprey from Lake Ontario to the remaining Great Lakes is presented. Information is presented obtained from questionnaires to Lake Huron about observations on sea lamprey on commercial fish catches. Experimental fishing procedures for lamprey and results are presented along with some recommendations on control methods and further investigations. (Canada Centre for Inland Waters).

344. MacKay, H. H. and W. H. R. Werner. 1964. Some observations on the culture of maskinonge. Transactions American Fish. Society. 64: 313-317.

When the value of the Maskinonge as a game fish was realized in Ontario, its capture by commercial means was prohibited, closed seasons were enacted and artificial culture and propogation was commenced. At the Belleville and Glenora fish hatcheries, observations were noted on hatching breeding habits, growth water requirements and methods of handling the young Maskinonge.

345. McAndrews, John H. Undated. Pollen analyses of the sediments of Lake Ontario. For publication by the 24th International Geological Congress, submitted October 15, 1971. Unnumbered.

Analyses were made on 91 surface sediment samples and values were derived of both percentages and concentrations (grains per gram dry sediment) of 61 taxa. Concentration was highest, over 80,000, in the deep-water clays but was less than 40,000 in shallow, near-shore silts and sands. Pollen of ragweed and tree pollen, especially Pine and Oak, dominate the relatively uniform assemblage, however, significant percentage variations reflect nearness to upland source regions, river discharges and recycling of sediment.

Two deep-water (over 180 m) cores at stations 80 km apart penetrate 5 to 7 m of pestglacial sediment and 9 to 11 m of late-glacial sediment. Eight pollen assemblage zones are present and correlate with radiocarbon and varve datd pollen assemblages from sediment of nearby small lakes. The pollen concentration of the seven postglacial zones is 35 times greater than the late-glacial spruce zone reflecting both greater pollen influx and the lesser rate of matrix accumulation. The ragweed zone begins at a depth 15 to 20 cm. from the surface and represents forest clearance around the lake beginning in the early 19th century.

346. McCombie, Allen M. 1967a. A recent study of the phytoplankton of the Bay of Quinte, 1964. Proceedings 10th Conference Great Lakes Research. pp. 37-62.

This study was undertaken to assess the quality and quantity of phytoplankton in different parts of the Bay of Quinte and compare present conditions at the mouth of that bay with those found there by Allen Tucker in 1945. Samples were collected from the inner, middle and outer bay and from the mouth of the Trent Canal, its main tributary. Phytoplankton concentrations in the inner bay were about 10 times those in the middle bay and about 100 times those at the mouth. Concentrations in the inner bay were about 10 times those in the middle bay and about 100 times those at the mouth. Concentrations in the Treant Canal were similar to those at the Bay mouth. Supersaturation of surface waters with dissolved oxygen and low Secchi disc readings in the inner and middle bay reflected the bloom concentrations of algae. In contrast, dissolved oxygen concentrations of 3 ppm or less were found at the bottom of the inner and middle bay at times in 1963 and 1964. Diatoms and bluegreen algae dominated the counts in all 3 years while greens and other classes amounted to less than 10%. There was no definite evidence of an increase in the phytoplankton concentrations at the bay since 1945. However, the diatoms Tabellaria and Fragillaria comprised a smaller fraction of the plankton there in 1963 and 1964 than in 1945, while blooms of the bluegreen Aphanezomenon began a month earlier in the latter years. Relations between the morphometric and edaphic conditions and the phytoplankton concentrations are discussed and possible effects of artificial enrichment considered. Some effects of currents on the phytoplankton distribution are also noted.

347. McCombie, Allen M. 1967b. Some physical and chemical characteristics of the Bay of Quinte. Canada Dept. Lands and Forests. Research Report No. 79. 56 p.

In recent years, there has been growing a concern amongst commercial fishermen, anglers and biologists that some parts of the Bay of Quinte may have become eutrophic to the point where the fish populations are endangered. Accordingly, the Research Branch of the Ontario Department of Lands and Forests undertook to study certain aspects of the bay during the summers of 1963 and 1964 in order to compare present conditions with those reported by Tucker (1949) and Pal (1958). As part of this study, two synoptic surveys were carried out on June 23 and August 25, 1964, in cooperation with the Division of Laboratories of the Ontario Water Resources Commission to determine the coliform counts, total alkalinities, water temperature, specific conductivities and the concentrations of total phosphorous, dissolved phsophorous, Kjeldahl nitrogen, ammonia nitrogen, iron, chlorides and phenols in different parts of the bay. This report deals primarily with the results of the synoptic surveys with occasional references to the results of the phytoplankton sampling. In addition to the comparison between present and past conditions in the Bay of Quinte the present conditions in that body are compared with these reported at various times for other parts of the Great Lakes and neighbouring waters.

348. McCrimmon, Hugh R. 1948. The reintroduction of Atlantic salmon into tributary streams of Lake Ontario. Transactions Americah Fish. Society. 78: 128-132.

Experimental plantings of Atlantic salmon (*Salmo salar*) fry were made in Duffin Creek, Ontario County, each year from 1944 to 1948. From 1945 to 1947 a large part of the creek was planted uniformly at a density of one fry per yard, regardless of local stream conditions. Each of these uniform plantings was followed by a study of the survival and distribution of the salmon during life in the creek. Populations were estimated by the use of a one-man hand seine. Each of the three uniform plantings resulted in the same pattern of survival over the stream system and showed the comparative suitability of various stream types for rearing salmon. Unsedimented gravelly riffles were found to be necessary for a high survival of newly planted fry. Subsequent survival to the smolt stage in areas not characterized by lethal summer temperatures was largely dependent on suitable habitats to accommodate the fish as they become larger. Capture of smolts during the spring of 1948 showed that at least 2% of the fry planted in 1946 reached Lake Ontario in 1948. From the study of the survival of salmon, it must be concluded that a number of sections of Duffin Creek are suitable for the rearing of salmon to the smolt stage. The fate of the salmon reaching Lake Ontario has yet to be determined. (Canada Centre for Inland Waters).

349. McCrimmon, Hugh R. 1950. The reintroduction of Atlantic salmon into tributary streams of Lake Ontario. Transactions Americah Fish. Society. 78: 128-132.

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350. McCrimmon, Hugh R. 1951. Atlantic salmon in tributary streams of Lake Ontario. Sylva. 7(4): 3-9.

A brief history of the salmon in Lake Ontario waters is given followed by a description of the experiment to determine whether or not Atlantic salmon can be re-introduced into tributary streams of Lake Ontario. (Univ. of Toronto, Main Library).

351. McCrimmon, Hugh R. and B. Bidgood. 1965. Abnormal Vertebrae in the rainbow trout with particular reference to electro-fishing. Transactions American Fish. Society. 94(1): 84-88.

Rainbow trout, *Salmo gaerdneri* Richardson, collected by A-C and D-C electrofishing from four geographically distinct Great Lakes watersheds including Wilmot Creek of Lake Ontario, were found, when X-rayed for taxonomic purposes, to include fish with abnormal vertebrae. The occurrence of these vertebrae in both immature and mature trout caused suspension that the condition has been caused by electrofishing. This paper reports on the natural occurrence of abnormal vertebrae among Ontario rainbow trout and a study on possible injurious effects of electrofishing on the vertebral column.

McLarty, D. A. - See: V. J. Bellis, No. 61.

McNaught, D. C. - See: M. W. Fenlon, No. 165.

McNeely, R. W. - See: C. F. M. Lewis, No. 332.

352. Maher, F. P. 1969. Our changing fish populations of the Great Lakes. Ontario Fish and Wildlife Review. 8(1): 2-8.

Many changes of fish species in the Great Lakes can be directly or indirectly attributed to mans activities. In Lake Ontario man has introduced carp and white perch, chenaok salmon, Coho salmon, kokanee and splake. The effects of these on Lake Ontario has not always been beneficial as planned or failed to establish themselves. The planned introduction of desirable exotic fish after careful investigation pursued by the Department of Lands and Forests should yield a substantial benefit to the sport and commercial fisheries of the lake.

Marin, L. - See: C. Nalewajko, No. 389.

Marion, R. M. - See: A. D. Tennant, No. 550.

353. Markello, Samuel J. and John F. Storr. 1971. The use of the Ross Fine Line Recording Fathometer as a tool for measuring fish distribution in Lake Ontario. Abstract of paper presented at the 14th Conference Great Lakes Research, Toronto, April 19-21, 1971. p. 148.

The above study attempted to quantify fish distribution both spacially and diurnally off a nuclear power plant at Nine Mile Point, during the summer and fall of 1970.

354. Marsh, C. Dwight. 1912. Notes on fresh-water copepoda in the United States National Museum. Proceedings U. S. National Museum. 42(1901): 245-255.

Presented in this paper is a list of the localities in which copepoda were found in plankton collections received from United States National Museum in 1911. Information on identification and distribution is presented. Concerning Lake Ontario only information on species of copepods from Sodus Bay, New York is included.

355. Mason, E. J. R. 1933. Smelts in Lake Ontario. Copeia. No. 1: 34.

Contains a brief note on the occurrence of a smelt, *Osmerus mordax*, on September 9, 1931 in Lake Ontario about 2 miles off Bowmanville.

356. Mather, Fred. 1881. Fishes which can live in both salt and fresh water. Transactions American Fish. Society. 10: 65-75.

Included in this article is a section on the striped bass in Lake Ontario. A note on the occurrence of a sea bass weighing 6 pounds caught in Chaumont Bay is given.

357. Mather, Fred. 1887. Report of operations at Cold Spring Harbor, New York, during the season of 1885. U. S. Commission Fish and Fisheries. Report for 1885. Part 13: 109-115.

The above is a report on the hatching and distribution of various species of Salmondiae and other fishes at the Cold Spring Harbor, New York station. With reference to Lake Ontario, 46,000 Penobscot salmon were planted in Oswego River, Lake Ontario.

358. Mather, Fred. 1889. Report of operations at Cold Spring Harbor, New York, during the season of 1886. U. S. Commission Fish and Fisheries. Report for 1886. Part 14: 721-728.

The above is a report on the hatching and distribution of various fish at the Cold Spring Harbor, New York station. With reference to Lake Ontario, 49,700 Atlantic salmon were planted in Oswego River, Lake Ontario.

Matheson, D. H. - See: M. G. Johnson, No. 298.

359. Matheson, D. H. 1958. A consolidated report on Burlington Bay. Dept. Municipal Laboratories, City of Hamilton, Hamilton, Ontario. Unnumbered.

This report is a summary of the results of surveys of the condition of Burlington Bay which have been made over the past quarter century. Biological data has been taken on coliform and total bacteria and a discussion of the deterioration in respect to sanitary conditions since 1923. In respect to plankton the population is assessed qualitatively and quantitatively and compared throughout the seasons, as well as to depth and location of station. In the phytoplankton, the diatoms and green algae are discussed most completely. Protozoans, Rotifers and Crustacea populations are also examined and information summarized in tables.

360. Matheson, D. H. 1962. A pollution study of Western Lake Ontario. Univ. of Michigan, Great Lakes Research Division. Publication No. 9. pp. 15-20.

In 1960 the Dept. of Municipal Laboratories of the city of Hamilton was commissioned to undertake a study of the western end of Lake Ontario with a view to determining the optimum location of a new waterworks intake. The area of the study extended from Hamilton to Bronte on the North shore, and a fifty mile point on the south shore. Several parameters of pollution were studied, one of them being coliform bacteria. The presence of coliform bacteria is one of the most widely used and most sensitive indicators of sanitary pollution. In this survey over 1800 samples were collected from the lake and analysed. The average value of coliform organisms in Lake Ontario were in relatively high concentrations along the shores with a rapid decline away from shore. There was a dose correlation between coliform and ammonia concentrations in the lake since both come from a common source.

361. Matheson, D. H. 1963. A sanitary survey study of the western end of Lake Ontario in connection with the locating of new water works intakes for the City of Hamilton, Ontario, 1961-1962. Dept. Municipal Laboratories Corp. of the City of Hamilton, Hamilton, Ontario. 110 p.

The degree of pollution of Hamilton intake water in respect to coliform counts has been constantly increasing over the years. Coliform determinations along with other parameters were used to determine the optimum location for water intake. Information on coliform concentrations was available from the Hamilton water intake records and Burlington Water Intake records. Samples were taken in Burlington Bay and Western Lake Ontario in 1960-1961. Previous studies were also included in the survey and detailed information has been compiled and summarized in tables and graphs.

362. May, Franklin H. 1923. Piping plover and black tern nesting at North Pond, Lake Ontario. The Auk. 40: 690-691.

Contains an observation of a Piping Plover nesting on a sandspit in North Pond on the south shore of Lake Ontario on July 14, 1923. On July 23, a colony of Black Terns were observed nesting on the same sandspit.

363. Meade, Gordon M. 1940. Franklin's gull in New York State. The Auk. 57: 251.

On October 15, 1939, on the beach at Ontario Beach Park on Lake Ontario at the mouth of the Genesee River, the author found a dead Franklin's Gull (*Laurus pipixcan*). This is apparently the first recorded instance of this species in New York State.

Meloon, D. T., Jr. - See: A. M. Cairo, No. 85.

364. Menon, A. S., B. J. Dutka and A. A. Jurkovic. 1971. Bacteriological studies of the Lake Ontario thermal bar. Abstract of paper presented at 14th Conference Great Lakes Research, Toronto, April 19-21, 1971. pp. 210-211.

This study was undertaken to assess the influence of the thermal bar in confining bacteria to the near-shore area during the spring period of rapid growth. Parameters studied in this investigation were total coliforms, fecal coliforms, 20°C MF plate count and bacterial biomass.

From the preliminary studies, it would appear that the thermal bar acts as a barrier, separating the warmer more productive inshore waters from the mid-lake waters and also may retard or inhibit the diffusion of bacteria from the inshore to the offshore area.

365. Metzer, D. F. 1968. Summary report on pollution of the Niagara River. Paper presented by the NYS Dept. of Health before the 16 January 1968 meeting of the International Joint Commission, Niagara Falls, New York. 9 p.

A general discussion of the water pollution of the Niagara River. With respect to the coliform contamination, it is thought that secondary treatment should bring the level of residual coliforms to the permissible limits.

366. Michalski, M. F. P. 1968. Phytoplankton levels in Canadian near shore waters of the lower Great Lakes. Proceedings 11th Conference on Great Lakes Research. pp. 85-95.

Phytoplankton averages determined from waterworks locations and off shore stations were lower in the St. Lawrence River and in the eastern end of Lake Ontario than in the western part. A bimodal pattern of seasonal development occurred at most locations sampled in Lake Ontario and the St. Lawrence River. High values were reported from samples collected in Hamilton Bay and Bay of Quinte.

The major phytoplankters in Lake Ontario included *Stephanodiscus tenuis* Hust., *Melosira islandica* O. Müll., *Fragilaria crotonensis* Kitt, *Tabellaria fenestrata* (Lyngb.) Kütz and *Oscillatoria* Vaucher. Representatives of the Chlorophyceae in Hamilton Bay and Myxophyceae in the Bay of Quinte dominated during the summer months.

In Lake Erie, average standing crops of phytoplankton decreased in order, from the western to the central, to the eastern basin. At Kingsville the levels and duration of spring and fall maxima reflected by the eutrophic condition of the western basin of Lake Erie.

The major forms at Kingsville were *Fragilaria capucina* Desm., *Fragilaria crotonensis*, *Stephanodiscus* Ehr., *Tabellaria fenestrata*, *Anacystis* Meneghini, *Anabaena* Bory and *Pediastrum duplex* Meyen. In the central and eastern basin the plankton included the same diatoms as well as *Ceratium hirundinella* (O.F.M.) Dujardin, *Peridinium* Ehr., *Dinobryon* Ehr., *Pediastum* Meyen and the desmid *Staurastrum* Meyen.

367. Michalski, M. F. P. 1969a. Investigations of daily variations in chemical, bacteriological and biological parameters at two Lake Ontario locations near Toronto. Proceedings 12th Conference Great Lakes Research. pp. 69-79.

Total standing stocks of phytoplankton from 10 July to 13 December, 1968 were higher in Toronto Harbour than at the R. C. Harris Water Filtration Plant. At both locations, the major algal species were *Stephanodiscus tenuis* Hust., *Fragilaria crotonensis* Kitt., *Tabellaria fenestrata* (Lyngb.) Kütz., *Chlamydomonas* spp. *Cryptomonas* spp. and *Aphizomenon floss-aquae* (L.) Ralfs.

Stephanodiscus Hantzschii Grun. was the most important diatom in the harbour but was virtually assent at the intake location.

Frequently at the water treatment plant, increases in standing stocks of algae and changes in species composition corresponded to changes in water temperature resulting from movements of the thermocline below the intake.

Samples collected once a week (in comparison with those obtained daily) were inadequate to define accurately extreme changes in phytoplankton levels; however, general trends were revealed through sampling every seventh day.

Higher indices of diversity were recorded at the R. C. Harris location than in Toronto Harbour.

368. Michalski, M. F. P. 1969b. Planktonic and periphytic algae of the Great Lakes - A list of recorded species and their distribution. In: Anderson, D. V. (Ed.). The Great Lakes as an Environment. Great Lakes Institute, Univ. of Toronto. Appendix 6(2): 40-66.

Presented in this paper is an extensive list by species of planktonic and periphytic algae in the Great Lakes. Earlier studies were used in compiling this list. Distribution is indicated only by lake. Where algal forms were recorded from a bay, harbour or lake, the associated Lake was indicated. (Canada Centre for Inland Waters).

369. Miller, G. W. 1930. The mortality of alewives (*Pomolobus pseudoharengus* Wilson) in Lake Ontario. Univ. of Toronto, Dept. Zoology. Manuscript 1-47. 45 p.

A discussion of the alewife including its habitat, economic importance and mortality is given. This is followed by an analysis of gross and microscopic anatomy, a pathological investigation and a physiological and experimental investigation all geared to determining the cause of the mortality of alewives. (Univ. of Toronto, Zoology Library).

370. Miller, Robert R. 1956. Origin and dispersal of the alewife, *Alosa pseudoharengus*, and the gizzard shad, *Dorasoma cepedianum*, in the Great Lakes. Transactions Americah Fish. Society. 86: 97-111.

It is possible that the alewife is native to Lake Ontario and the gizzard shad to Lake Erie, although conclusive evidence for this is lacking. There appears to be no records of the alewife from Lake Ontario prior to 1873, after the lake had been stocked with American shad. A tabular comparison of these species is given to facilitate identification. The alewife is referred to the genus Alosa (rather than Pomolobus) because no reliable characteristics are available to distinguish the species of these two groups. The phenominal increase in abundance and spreading of the alewife may be correlated with the upset in population balance by the sea lamprey.

The gizzard shad does not occur north of lower New York Harbor although it has been reported from New Brunswick, where it is probably misidentified for the alewife. Its inland range has been extended by canal connections including the Erie and Chicago River Canals.

371. Miller, Robert R. 1960. Systematics and biology of the gizzard shad (*Dorosoma cepedianum*) and related fishes. U. S. Fish and Wildlife Service Fishery Bulletin 173. 60: 371-392.

The gizzard shads, marine and freshwater herrings of the subfamily Dorosomatinae, are characterized and keys are given to the seven known genera and to the five species of the American genus *Dorosoma*. The systematics and biology of the eastern gizzard shad are treated in detail. The biological information results largely from a critical survey of papers dealing with its fecundity, reproduction and development, size, age and growth abundance, habitat and migration, mortality parasites and predators, its food, forage values and utilization by man.

372. Mills, Henry. 1882a. Notes on the spongillae of Buffalo. Bulletin Buffalo Natural Science. 4: 57-60.

In October of 1879, Mr. D. S. Kellicott found the first specimen of sponge on the pier at Black Rock near Squaw Island. Subsequently, three other specimens have been found by he and the author. One of them is supposedly new to science. These objects were found in the microscopic examination of water from Niagara River The three specimens were named *Carterella tenosperma*, C. *latitenta* and C. *tubisperma* after the celebrated spongiologist of England, Mr. Carter.

373. Mills, Henry. 1882b. Microscopic organisms in the Buffalo water supply and in Niagara River. Proceedings American Society Microscoptists. 4: 165-175.

Microscopic examinations were made of the Buffalo Water Supply and the Niagara River. Concerning the microorganisms found in the Niagara River often found were diatoms such as Fragillaua Synedra and Newecula. Other flora included chara and Niletta. The fauna observed included were ophyrdium and tardigroda.

374. Milner, J. W. 1874. Report on the fisheries of the Great Lakes. The result of inquiries prosecuted in 1871 and 1872. Report of U. S. Fish. Commission, 1872-1873. Part II. pp. 1-64.

The work for this report was carried out in 1871 in the form of a survey of the fishermen and fish dealers throughout the Great Lakes region. A collection of fish and invertebrate forms was compiled from the survey of Lake Michigan. The fisheries of Lake Superior, the Detroit River and a portion of Lake Erie were examined and information gathered with reference to fishing interests and further compilation of a fish collection. In Lake Ontario, it is noted that the fisheries on either side of the lake are more reduced than in any of the other lakes. Only a few fishermen are engaged on the American side with a comparatively small supply of fish afforded. Also noted by the author is a decrease in the food fishes especially in the more heavily fished lakes.

Mitchell, H. D. - See: C. S. Beardslee, No. 52.

375. Moore, Emmeline. 1927. Introduction - A biological survey of the Genesee River system. NYS Conservation Dept. Supplemental 16th Annual Report for 1926. Biological Survey. pp. 5-11.

In April, 1926, the Legislature appropriated $15,000 to initiate a program to determine the most practical methods of increasing fish production. The Genesee

River system became the subject of this study because of a proposed development of power and regulatory projects along this river system. The development of a stocking policy of fish propagated in the hatcheries of the State will be formulated during this program. Information concerning the pollution conditions which exist throughout the water shed will be secured by means of biological and chemical studies. A study of the species of fish along with their food preferences will also be compiled. A brief study of Silver Lake and Conesus Lake is also included.

376. Moore. Emmeline. 1928. Introduction - A biological survey of the Oswego River system. NYS Conservation Dept., Supplemental 17th Annual Report for 1927. Biological Survey. pp. 9-16.

This report includes an introduction to the biological survey of the Oswego watershed. A description of the area covered by the survey, authorization of survey, statistics on fish planting, program of investigation personnel and short descriptions of some of the papers included in the survey. A list of specific papers in the survey is also presented.

377. Moore, Emmeline. 1929. A biological survey of the Erie-Niagara system. Introduction. NYS Conservation Dept. Supplemental 18th Annual Report for 1928. Biological Survey. pp. 8-18.

The report of the biological survey incorporates a series of papers dealing with the fisheries of the Erie-Niagara system. Three major lines of inquiry were pursued - the study of the deeper water at the eastern end of the lake with special emphasis on factors limiting productivity; the investigation of the general shore conditions; and an evaluation of the tributary streams and their headwaters in relation to stocking policy. A general program of the Erie-Niagara Survey is described along with statistics of fish planting in the Lower Niagara River between 1918-1927, and colored plates of those fish of particular interest.

378. Moore, Emmeline. 1932. Introduction - A biological survey of the Oswegatchie and Black River systems (including also the Lesser Tributary Streams of the Upper St. Lawrence River and of Northeastern Lake Ontario). NYS Conservation Dept., Supplemental 21st Annual Report for 1931. Biological Survey. 6: 1-7.

This report is an introduction to the biological survey of the Oswegatchie and Black River watershed. A description of the area covered by the survey, statistics on fish planting, program of investigation, personnel and a list of papers done in the survey is presented.

379. Moore, Emmeline. 1940. A biological survey of the Lake Ontario watershed (including all waters from Little Sandy Creek westward except the Genesee and Oswego River systems). Introduction. NYS Conservation Dept., Supplemental 29th Annual Report for 1939. Biological Survey. pp. 9-19.

This survey report deals with results of the fisheries studies conducted during the season of 1939 in the Lake Ontario watershed. The area covered extends from Little Sandy Creek westward to the Niagara River and includes all tributaries except the Genesee and Oswego River systems.

In the investigations, technical studies were directed toward those aspects in the environment of fish life which are related to the maintenance and improvement of the fish resources. Included are studies on the following: the relationship between Lake Ontario and the natural features presented by the numerous bays and wide stream mouths tributary to the lake; an inventory of the fishes of the region and their distribution; life history and growth rate data of several species; evaluation of streams and ponds as a basis for an improved stocking policy; the evaluation of natural reproduction in the angling species; fishing possibilities in the quarry ponds; the amount and quality of food materials; chemical investigations of polluted situations in public fishing waters; the examination of fish for evidence of disease and studies of the life cycle of fish parasites; a survey of the larger aquatic plants in bays, streams and ponds; and the problem of the carp population in Sodus Bay.

380. Morgan, George. 1883. Capture of land-locked salmon at Oswego, New York. Bulletin U. S. Fish Commission for 1882. 2: 15.

Brief note on the occurrence of an individual salmon taken at Oswego while pumping out a dry-dock.

381. Mueller, J. F. 1940. Parasitism and disease in fishes of the Lake Ontario watershed. NYS Conservation Dept., Supplemental 29th Annual Report for 1939. Biological Survey. pp. 211-225.

A total of 266 fish, representing 31 different species, were examined for external and internal parasites. In connection with life history studies of the parasites, 24 birds were examined. The alewife was intensively studied to determine the cause of the heavy mortality annually observed in this species during the early part of the summer. All specimens of the genus *Esox* collected by the field units were examined for *Trichodina* in the urinary bladder. Relatively few species of gill parasites were encountered. Lake Ontario salmanids are heavily infested with the swim bladder parasite, *Cysticicola stigmatura*. Fishes of Lake Ontario appear to be free of the plero cercoid of the potential human parasite *Diphyllabothrium latum*.

Meunscher, W. C. - See: R. D. Wood, No. 591.

382. Meunscher, W. C. 1929. A biological survey of the Erie-Niagara system. VIII. Vegetation of the Niagara River and the eastern end of Lake Erie. NYS Conservation Dept., Supplemental 18th Annual Report for 1928. Biological Survey. pp. 189-197.

A brief survey of the distribution and composition of the vegetation in the Niagara River and the eastern end of Lake Erie was made between August 14-30, 1928. This report covers observations made on the American side of the Niagara River, including the shores of Grand Island and several small islands near it, as well as the shallow channels between the islands and from Buffalo Harbor along the south shore of Lake Erie to the Pennsylvania State boundary. A list of aquatic plants observed throughout this study is included.

383. Muenscher, W. C. 1932. Aquatic vegetation of the Oswegatchie and Black River watersheds (including the eastern end of Lake Ontario and the upper stretch of the St. Lawrence). NYS Conservation Dept., Supplemental 21st Annual Report for 1931. Biological Survey. 6: 199-221.

During the summer of 1931, a study of the aquatic vegetation was undertaken. The report is divided into two parts. The first part is a discussion of the location and composition of the principal areas of aquatic vegetation within the area surveyed. The second part consists of a annotated list of all the species of larger aquatic plants in the watershed surveyed during the summers of 1930 and 1931.

The present discussion of the vegetation is limited to the larger aquatic plants, most of which grow attached to the bottom in shallow water usually not over five meters in depth. The microscopic free-living and suspended plants which form a part of the plankton life of a body of water are discussed in another part of the report.

The discussion is based upon a field study of the bays of Lake Ontario from Stoney Point northward to Cape Vincent, the American side of the St. Lawrence River from its mouth to the mouth of the Oswegatchie River to Ogdensburg, and the watersheds of the Black and Oswegatchie River systems.

Mukerji, G. N. - See: V. C. Vladejkav, No. 574.

Munawar, Mohiuddin and Arnold Nauwerck. 1971. Composition and horizontal distribution of phytoplankton in Lake Ontario during the year 1970. Abstract of paper presented at the 14th Conference Great Lakes Research, Toronto, April 19-21, 1971. pp. 216-217.

The above is a qualitative and quantitative study of the phytoplankton collected for one year over the entire lake.

Nalewajko, C. - See: J. H. Sparling, No. 533.

385. Nalewajko, C. 1965a. Photosynthesis and excretion in various planktonic algae. Limnology and Oceanography. 11(1): 1-10.

Twenty-four species of planktonic algae, including 16 Chlorophyceae, seven Bacellariophycaea and one Cyanophyceae, were found to libuate a part of their photosynthetic products into the medium. This excretion was less than 2% of the total carbon fixed during photosynthesis in short term experiments with dilute cell suspensions under conditions of abundant CO_2 supply and limiting or saturating light intensities.

Excretion was increased at high population density, under conditions of limiting CO_2 levels and at light intensities sufficient to inhibit intensities.

Excretion values in *Chlorella phyrnoidosa* chick were usually lower than in other species under the same environmental conditions.

386. Nalewajko, C. 1966b. Dry weight, ash and volume data for some freshwater planktonic algae. Journal Fisheries Research Board Canada. 23(8): 1285-1288.

Numerical records of abundance of phytoplankton in a lake may result in a misrepresentation of the true importance of certain species because of the large differences in size of various planktonic algae. Lund (1964) pointed out that counts of phytoplankton could be made more valuable if data were available on the relationship between cell numbers and dry weight and volume in these species.

Data presented here were collected in conjunction with estimations of standing crop of phytoplankton in Lake Ontario and during an investigation in which excretion rates in various planktonic algae were compared on an ash-free, dry-weight basis. All data were obtained using cultures in the expotential phase of growth, to avoid differences in cell composition which may occur in old cultures following nutrient depletion.

387. Nalewajko, C. 1966c. Composition of phytoplankton in surface waters of Lake Ontario. Journal Fisheries Research Board Canada. 23(11): 1715-1725.

Few data are available on the composition of phytoplankton in Lake Ontario in comparison to the other Great Lakes. In the present investigations, seasonal fluctuations of phytoplankton were followed during 19 months (January 1964 to July 1965) at one location in the lake, and in addition samples from other locations were examined to obtain some indication of the type of phytoplankton occurring in the whole lake.

Stephanodiscus tenuis Hust., *Melosira islandica* O. Mull., and *Diatoma elongatum* (Lyngl.) Ag., on a cell volume basis, were the three most important species in the surface water of Lake Ontario near Gilbraltar Point. *Stephonodiscus tenuis* was by far the most abund nt species. It was present during most of the year and accounted for about 87% of the total number of algae present during the spring outbursts. In the more central areas of the lake *Melosira islandica* and *Asterionella formosa* Hass. replaced *Stephanodiscus* *tenuis* as the most important species.

On the basis of the major phytoplankton species present the central area of Lake Ontario appears to be oligotrophic. High numbers of *Stephanodiscus tenuis* in inshore waters may be indicative of a more eutrophic environment.

388. Nalewajko, C. 1967. Phytoplankton distribution in Lake Ontario. Proceedings 10th Conference Great Lakes Research. pp. 63-69.

In April 1965 the phytoplankton of the coastal zone of Lake Ontario within approximately six miles of the shore differed quantitatively and also in species composition from more central areas of the lake. In general, algae were two or three times as abundant close to shore with *Stephanodiscus tenuis* Hust accounted for only 1.8-10% of the total numbers of algae and *Melosira islandica* Mill. and *Asterionella formosa* Hass. were the most prominant species.

Stephanodiscus increases rapidly in the spring, and the -evelopment of the thermal bar confines it to the warmer coastal zone. Gradually, as the thermal bar moves away from the shore, *Stephanodiscus* spreads to more central areas of the lake, however, it never reaches comparable numbers there. Since the thermal bar has been reported to impede runoff, the abundance of *Stephanodiscus* may be attributed to the higher nutrient concentrations in the coastal zones.

The distribution of *Melosira islandica* with the highest numbers of the isothermal cold waters on the offshore side of the thermal bar and low numbers on the inshore side can be explained by the increased sinking rate of the diatom due to decreased turbulence on the establishment of thermal stratification.

389. Nalewajko, C. and L. Marin. 1968. Extracellular production in relation to growth of four planktonic algae and of phytoplankton populations from Lake Ontario. Canadian Journal Botany. 47(3): 405-413.

The liberation of extracellular organic material by algae during short-term photosynthesis experiments is a well-established phenomenon and the physiology of the process has been investigated by a number of workers. Recently (Witt and Fogg, 1966), it has been shown that in *Chlorella pyrenoidosa* (Emerson strain) the relative growth rate of the alga is an important factor in the amounts of extracellular glycollate produced.

Data are presented here on the relationship between photosynthesis and extracullular production and relative growth rate in four planktonic algae. In addition, photosynthesis and excretion were measured during the spring increase of diatoms in Lake Ontario in 1966.

390. Nash, C. W. 1901. The bass of Ontario. Canadian Magazine Politics, Science, Art and Literature. 17: 333-336.

The article discusses bass fishing in Ontario, open season beginning commencing on the 16th day of June. The bass family in Ontario is represented by nine species, two Black Bass, white bass speckled bass, rock bass and four sunfish. Its well-earned repute is due to its game fishing qualities when hooked, and in the respect it is without a doubt, at equal weights, the superior of any fish that swims. The author mentions seeing bass nets in Lake Ontario after the fishing season had open up. (Univ. of Toronto, Zoology Library).

391. Nash, C. W. 1905. A check list of the vertebrates of Ontario and catalogue of specimens in the biological section of the Provincial Museum: Reptiles, Batrachians, Mammals. Dept. Education, Toronto. 32 p.

The Batrachians and Reptiles of Ontario have not been studied to any extent and few collections have been made. When more attention is given to these animals, many North American species now known to occur in the United States immediately adjoining Ontario may be found generally distributed through the province. This paper includes a list of vertebrates which occur in Ontario. For each organism, a description of the distribution is given. (Univ. of Toronto, Dept. Zoology).

392. Nash, C. W. 1913. XIX. Fishes. In: Faull, J. H. (Ed.). The Natural History of the Toronto region, Ontario. Canadian Institute, Toronto. pp. 249-271.

The list includes all the fish found within a radius of ten or twelve miles from the City of Toronto. The silver lamprey and 48 species of fish are listed as occurring in Lake Ontario and/or its tributaries. (Toronto-Royal Ontario Museum).

393. Nathan, Bernard. 1954. Aggressiveness of herring gulls. Prothonotary. 20(10): 88.

A short note about an incident where a herring gull chased a great blue herring across the Niagara River.

Nauwerck, Arnold - See: Mohiuddin Munawar, No. 384.

394. Neil, John H. and Glenn E. Owen. 1964. Distribution, environmental requirements and significance of *Cladophora* in the Great Lakes. Univ. of Michigan, Great Lakes Research Division. Proceedings 7th Conference Great Lakes Research. Pub. 11: 113-121.

Excessive growths of *Cladophora* sp. along certain sections of the Great Lakes shoreline creates serious nuisance conditions which affect the use of water for recreations, industrial and municipal purposes. Information on the ecology of this algae was collected as part of a study directed towards the development of control measures. The presence of *Cladophora sp.* is dependent on a suitable substrate for attachment, water movement, adequate light and nutrients in excess of those normally available in the waters of the upper Great Lakes. Lakes Ontario and Erie have sufficient inherent fertility to support marginal growths, but where local nutrient sources are available, production increases. Phosphorus applied to a location providing suitable physical conditions but devoid of *Cladophora* sp. resulted in the establishment of a sizeable area of growth. The results of attempts at control are also discussed.

Nemerow, Nelson L. - See: Daniel F. Jackson, No. 293.

395. New York State Conservation Commission- 1924. 13th Annual Report for the Year 1923. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 30: 93-97.

The commercial catch in Lake Ontario for 1922 amounted to 365,988 pounds with a value of $51,694. Information is also given for Sodus Bay, Fairhaven Bay, Chaumont Bay and the Niagara River.

396. New York State Conservation Commission. 1925. 14th Annual Report for the Year 1924. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 29: 52-63.

The commercial catch in Lake Ontario for 1923 amounted to 391,156 pounds with a value of $64,429. Information is also given for Port Bay, Sodus Bay and Chaumont Bay.

397. New York State Conservation Commission. 1926. 15th Annual Report for the Year 1925. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 28: 53-63.

The commercial catch in Lake Ontario for 1924 amounted to 745,443 pounds with a value of $73,282. Information is also given for Port Bay, Great and Little Sodus Bay, Chaumont Bay and the Niagara River.

398. New York State Conservation Commission. 1927. 16th Annual Report for the Year 1926. Division of Fish and Game -- Bureau of Inland Fisheries. Legislative Document No. 29: 90--99.

Included in this report is a table on the commercial catch in Lake Ontario for 1925. A total of 18 species plus a misc. group accounted for 445,938 pounds with a value of $57,797. Information is also given for Port Bay, Sodus Bay, Chaumont Bay, Black River Bay and the Niagara River.

399. New York State Conservation Department. 1928. 17th Annual Report for the Year 1927. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 38: 299-312.

Included in this report is a table on the commercial catch in Lake Ontario for 1926. A total of 16 species plus a misc. group accounted for 451,348 pounds with a value of $58,419. Information is also given for Port Bay, Sodus Bay, Chaumont Bay and Black River Bay.

400. New York State Conservation Department. 1929. 18th Annual Report for the Year 1928. Division of Fish ang Game - Bureau of Inland Fisheries. Legislative Document No. 38: 265-278.

Included in this report is a table on the commercial catch in Lake Ontario for 1927. A total of 14 species accounted for 399,740 pounds with a value of $57,046. Information is also given for Port Bay, Sodus Bay, Chaumont Bay and the Niagara River.

401. New York State Conservation Department. 1930. 19th Annual Report for the Year 1929. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 38: 257-269.

Included in this report is a table on the commercial catch in Lake Ontario for 1928. A total of 15 species plus a misc. group accounted for 577,044 pounds with a value of $71,209. Information is also given for Port Bay, Sodus Bay and Chaumont Bay.

402. New York State Conservation Department. 1931. 20th Annual Report for the Year 1930. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 38: 275-282.

Included in this report is a table on the commercial catch in Lake Ontario for 1929. A total of 14 species plus a misc. group accounted for 538,936 pounds with a value of $73,646. Information is also given for Port Bay, Sodus Bay and Chaumont Bay.

403. New York State Conservation Department. 1932. 21st Annual Report for the Year 1931. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 38: 251-262.

Included in this report is a table on the commercial catch in Lake Ontario for 1930. A total of 14 species plus a misc. group accounted for 435,516 pounds with a value of $42,922. Also included is a table on the catch statistics for Chaumont Bay.

404. New York State Conservation Department. 1933. 22nd Annual Report for the Year 1932. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 38: 256-277.

Included in this report is a table on the commercial catch in Lake Ontario for 1931. A total of 13 species plus a misc. group accounted for 250,092 pounds with a value of $21,042. Also included is a table on the catch statistics for Chaumont Bay.

405. New York State Conservation Department. 1934. 23rd Annual Report for the Year 1933. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 38: 232-247.

Included in this report is a table on the commercial catch in Lake Ontario for 1932. A total of 15 species plus a misc. group accounted for 187,051 pounds with a value of $16,397. Also included is a table on the catch statistics for Chaumont Bay.

406. New York State Conservation Department. 1935. 24th Annual Report for the Year 1934. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 38: 246-262,

Included in this report is a table on the commercial catch in Lake Ontario for 1933. A total of 15 species plus a misc. group accounted for 352,620 pounds with a value of $25,926. Also included is a table on the catch statistics for Chaumont Bay.

407. New York State Conservation Department. 1936. 25th Annual Report for the Year 1935. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 38: 305-319.

Included in this report is a table on the commercial catch in Lake Ontario for 1934. A total of 14 species plus a misc. group accounted for 404,830 pounds with a value of $34,215. Also included is a table on the catch statistics for Chaumont Bay.

408. New York State Conservation Department. 1937. 26th Annual Report for the Year 1936. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 38: 278-288.

Included in this report is a table on the commercial catch in Lake Ontario for 1935. A total of 15 species plus a misc. group accounted for 447,931 pounds with a value of $38,091. Also included is a table on the catch statistics for Chaumont Bay.

409. New York State Conservation Department. 1938. 27th Annual Report for the Year 1937. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 38: 253-261.

Included in this report is a table on the commercial catch in Lake Ontario for 1936. A total of 15 species plus a misc. group accounted for 281,657 pounds with a value of $31,773. Also included is a table on the catch statistics for Chaumont Bay.

410. New York State Conservation Department. 1939. 28th Annual Report for the Year 1938. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 38: 229-239.

Included in this report is a table on the commercial catch in Lake Ontario for 1936 and 1937. A total of 14 species plus a misc. group accounted for 281,657 pounds with a value of $31,773 in 1936. A total of 14 species accounted for 303,461 pounds with a value of $33,024 in 1937. Also included is a table on the catch statistics for Chaumont Bay.

411. New York State Conservation Department. 1940. 29th Annual Report for the Year 1939. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 38: 222-229.

Included in this report is a table on the commercial catch in Lake Ontario for 1937 and 1938. A total of 14 species accounted for 303,461 pounds with a value of $33,024 in 1937. A total of 12 species plus a misc. group accounted for 349,702 pounds with a value of $35,387. Also included is a table on the catch statistics for Chaumont Bay.

412. New York State Conservation Department. 1941a. Lake Ontario and St. Lawrence bass problem. 30th Annual Report for the Year 1940. pp. 203-204.

Presented in this short note was some information on the black bass is the eastern end of Lake Ontario. Included in some general results of a survey of bass fishing areas and conditions. It was noted that the bass food supply may be limiting the growth of the bass due to competition of the rock bass. Also heavy sport fishing pressure is also a problem.

413. New York State Conservation Department. 1941b. 30th Annual Report for the Year 1940. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 37: 205-212.

Included in this report is a table on the commercial catch in Lake Ontario for 1938 and 1939. A total of 12 species plus a misc. group accounted for 349,702 pounds with a value of $35,387 in 1938. A total of 14 species plus a misc. group accounted for 342,942 pounds with a value of $35,952 in 1939. Also included is a table on the catch statistics for Chaumont Bay.

414. New York State Conservation Department. 1942. 31st Annual Report for the Year 1941. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 32: 198-209.

Included in this report is a table on the commercial catch in Lake Ontario for 1939 and 1940. A total of 14 species plus a misc. group accounted for 342,942 pounds with a value of $35,952 in 1939. A total of 11 species plus a misc. group accounted for 366,743 pounds with a value of $40,850 in 1940. Also included is a table on the catch statistics for Chaumont Bay.

415. New York State Conservation Department. 1943. 32nd Annual Report for the Year 1942. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 27: 173-187.

Included in this report is a table on the commercial catch in Lake Ontario for 1940 and 1941. A total of 11 species plus a misc. group accounted for 366,743 pounds with a value of $40,850 in 1940. A total of 12 species accounted for 284,650 pounds with a value of $35,872 in 1941. Also included is a table on the catch statistics for Chaumont Bay.

416. New York State Conservation Department. 1944. 33rd Annual Report for the Year 1943. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 25: 127-142.

Included in this report is a table on the commercial catch in Lake Ontario for 1941 and 1942. A total of 12 species accounted for 284,650 pounds with a value of $35,872 in 1941. A total of 10 species accounted for 140,665 pounds with a value of $24,548 in 1942. Also included is a table on the catch statistics for Chaumont Bay.

417. New York State Conservation Department. 1946. 34th-35th Annual Report for the Years 1944-1945. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 61: 159-164.

No table on the catch statistics for Lake Ontario is given in this report. A table on the catch statistics for Chaumont Bay, however, is included.

418. New York State Conservation Department. 1947. 36th Annual Report for the Year 1946. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 85: 140-154.

Included in this report is a table on the commercial catch in Lake Ontario in 1944 and 1945. A total of 19 species plus a misc. group accounted for 147,188 pounds with a value of $16,550 in 1944. A total of 15 species accounted for 217,076 pounds with a value of $44,555 in 1945. Also included is a table on the catch statistics for Chaumont Bay.

419. New York State Conservation Department. 1948a. 37th Annual Report for the Year 1947. Division of Fish and Game - Bureau of Fish and Wildlife Investigations. Legislative Document No. 62: 111-134.

Included in this report is a section on the Oswegatchie River Pike-Perch Study. The experimental project began in 1947 to determine if it is feasible to net the spawning pike-perch and transplant them upstream in the Oswegatchie River and other suitable waters in the vicinity. On the basis of the first year's recoveries, it appears that a large percentage of planted fish attempted to return to the St. Lawrence River. The securing of additional data on the fate of the tagged fish should determine whether the transplanting of adult pike-perch from the lower Oswegatchie to other suitable waters is a sound management practice.

Also included is a section on the Lake Ontario-St. Lawrence River Smallmouth Bass Investigation. Over the 1944-1946 period, 1,849 smallmouth bass have been tagged and released in the Lake Ontario-St. Lawrence River region to obtain information on migration and growth which will aid future management of this sport fishery.

420. New York State Conservation Department. 1948b. 37th Annual Report for the Year 1947. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 62: 134-140.

Included in this report is a table on the commercial catch in Lake Ontario for 1945 and 1946. A total of 15 species accounted for 217,076 pounds with a value of $44,555 in 1945. A total of 14 species accounted for 218,500 pounds with a value of $42,964 in 1946. Also included is a table on the catch statistics for Chaumont Bay.

421. New York State Conservation Department. 1950. 39th Annual Report for the Year 1949. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 76: 146-163.

Included in this report is a table on the commercial catch in Lake Ontario for 1947 and 1948. A total of 11 species accounted for 274,772 pounds with a value of $55,605 in 1947. A total of 14 species accounted for 200,381 pounds with a value of $41,032 in 1948. Also included is a table on the catch statistics for Chaumont Bay.

422. New York State Conservation Department. 1951. 40th Annual Report for the Year 1950. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 48: 156-183.

Included in this report is a table on the commercial catch in Lake Ontario for 1948 and 1949. A total of 14 species accounted for 200,381 pounds with a value of $41,032 in 1948. A total of 14 species accounted for 139,206 pounds with a value of $26,094 in 1949. Also included is a table on the catch statistics for Chaumont Bay.

423. New York State Conservation Department. 1952. 41st Annual Report for the Year 1951. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 78: 156-189.

Included in this report is a table on the commercial catch in Lake Ontario for 1949 and 1950. A total of 14 species accounted for 139,206 pounds with a value of $26,094 in 1949. A total of 15 species accounted for 94,469 pounds with a value of $27,284 in 1950. Also included is a table on the catch statistics for Chaumont Bay.

424. New York State Conservation Department. 1953. 42nd Annual Report for the Year 1952. Division of Fish and Game - Bureau of Inland Fisheries. Legislative Document No. 27: 158-208.

Included in this report is a table on the commercial catch in Lake Ontario for 1950 and 1951. A total of 15 species accounted for 94,469 pounds with a value of $27,284 in 1950. A total of 16 species accounted for 475,277 pounds with a value of $104,939 in 1951. Also included is a table on the catch statistics for Chaumont Bay.

425. New York State Conservation Department. 1954. 43rd Annual Report for the Year 1953. Division of Fish and Game - Bureau of Fish. Legislative Document No. 47: 127-202.

Included in this report is a table on the commercial catch in Lake Ontario for 1951 and 1952. A total of 16 species accounted for 475,277 pounds with a value of $104,939 in 1951. A total of 17 species accounted for 515,320 pounds with a value of $85,544 in 1952. Also included is a table on the catch statistics for Chaumont Bay.

426. New York State Conservation Department. 1955. 44th Annual Report for the Year 1954. Division of Fish and Game - Bureau of Fish. Legislative Document No. 47: 125-173.

Included in this report is a table on the commercial catch in Lake Ontario for 1952 and 1953. A total of 17 species accounted for 515,320 pounds with a value of $85,544 in 1952. A total of 18 species accounted for 128,211 pounds with a value of $42,495 in 1953. Also included is a table on the catch statistics for Chaumont Bay.

427. New York State Conservation Department. 1956. 45th Annual Report for the Year 1955. Division of Fish and Game - Bureau of Fish. Legislative Document No. 88: 100-130.

The commercial catch for 1954 amounted to 175,806 pounds with a value of $35,708. Catch statistics for Chaumont Bay were reported in tabular form.

428. New York State Conservation Department. 1957. 46th Annual Report for the Year 1956. Division of Fish and Game - Bureau of Fish. Legislative Document No. 114: 100-130.

The total catch for Lake Ontario declined which was attributed to the decline of the blue pike even though there were minor increases in the yellow perch, ciscoes and whitefish. A table on the catch statistics for Chaumont Bay is given.

429. New York State Conservation Department. 1958. 47th Annual Report for the Year 1957. Division of Fish and Game - Bureau of Fish. Legislative Document No. 110: 102-134.

Included in this report is a table on the commercial catch in Lake Ontario for 1955 and 1956. A total of 16 species accounted for 90,907 pounds with a value of $22,118 in 1955. A total of 16 species accounted for 60,183 pounds with a value of $17,330 in 1956. Also included is a table on the catch statistics for Chaumont Bay.

430. New York State Conservation Department. 1959. 48th Annual Report for the Year 1958. Division of Fish and Game - Bureau of Fish. Legislative Document No. 109: 94-127.

Included in this report is a table on the commercial catch in Lake Ontario for 1956 and 1957. A total of 16 species accounted for 60,183 pounds with a value of $17,330 in 1956. A total of 18 species accounted for $42,866 pounds with a value of $12,764 in 1957. Also included is a table on the catch statistics for Chaumont Bay.

431. New York State Conservation Department. 1960. 49th Annual Report for the Year 1959. Division of Fish and Game - Bureau of Fish. Legislative Document No. 105: 93-120.

Included in this report is a table on the commercial catch in Lake Ontario for 1958. A total of 17 species accounted for 43,457 pounds with a value of $13,065. Also included is a table on the catch statistics for Chaumont Bay.

432. New York State Conservation Department. 1961. 50th Annual Report for the Year 1060. Division of Fish and Game - Bureau of Fish. Legislative Document No. 104: 86-108.

Included in this report is a table on the commercial catch in Lake Ontario in 1959. A total of 17 species accounted for 39,693 pounds with a value of $8,926. Also included is a table on the catch statistics for Chaumont Bay.

433. New York State Conservation Department. 1962. 51st Annual Report for the Year 1961. Division of Fish and Game - Bureau of Fish. Legislative Document No. 105: 95-113.

Included in this report is a table on the commercial catch in Lake Ontario for 1960. A total of 17 species accounted for 67,481 pounds with a value of $21,376. Also included is a table on the catch statistics for Chaumont Bay.

434. New York State Conservation Department. 1963. 52nd Annual Report for the Year 1962. Division of Fish and Game - Bureau of Fish. Legislative Document No. 106: 99-116.

Included in this report is a table on the commercial catch in Lake Ontario in 1961. A total of 18 species accounted for 124,605 pounds with a value of $14,879. Also included is a table on the catch statistics for Chaumont Bay.

435. New York State Conservation Department. 1964. 53rd Annual Report for the Year 1963. Division of Fish and Game - Bureau of Fish. Legislative Document No. 101: 97-114.

Included in this report is a table on the commercial catch in Lake Ontario for 1962. A total of 20 species accounted for 66,531 pounds with a value of $22,209. Also included is a table on the catch statistics for Chaumont Bay.

436. New York State Conservation Department. 1965. 54th Annual Report for the Year 1964. Division of Fish and Game - Bureau of Fish. Legislative Document No. 98: 92-105.

Included in this report is a table on the commercial catch in Lake Ontario for 1963. A total of 10 species accounted for 80,140 pounds with a value of $18,580. Also included is a table on the catch statistics for Chaumont Bay.

437. New York State Conservation Department. 1966. 55th Annual Report for the Year 1965. Division of Fish and Game - Bureau of Fish. Legislative Document No. 98: 86-93.

Included in this report is a table on the commercial catch in Lake Ontario for 1964. A total of 10 species accounted for 90,100 pounds with a value of $26,485. Also included is a table on the catch statistics for Chaumont Bay.

438. New York State Department of Environmental Conservation. 1967. Periodic report of the water quality surveillance network, 1965 - 1967 water years. NYS Dept. Environmental Conservation, Albany, N. Y. 390 p.

This report is an evaluation of the results and the effects of the NYS water pollution abatement program upon the quality of the State's water. This water pollution abatement program encompasses: the construction of municipal and industrial waste treatment works; an intensified enforcement program; the granting of financial aid and tax incentives; research; and water quality surveillance. This information can be used to establish water quality standards by the State Water Resources Commission.

439. New York State Department of Health. 1957. Eighteenmile Creek drainage basin and other tributaries entering Lake Ontario between Niagara River and Eighteenmile Creek. Lake Ontario Drainage Basin Survey Series No. 3. 71 p.

This is a report on the survey and studies of the surface waters of Eighteenmile Creek and other tributaries entering Lake Ontario between Eighteenmile Creek and the Niagara River. The report includes recommended classifications for the waters surveyed. Determination of present defilement is in part from coliform organisms. Data is included in graphs and charts. Fishing and fish culture is mentioned; problems and species present are briefly discussed.

440. New York State Department of Health. 1958. Lake Ontario surface waters including specified tributaries. Lake Ontario Drainage Basin Survey Series No. 4. 447 p.

A biological, physical and chemical study of Lake Ontario and its tributaries. The report emphasizes the physical and chemical parameters with only minor attention given to the biological aspects. Discussion of fish culture, the effects of pollution on fish and coliform counts are included in the report.

441. New York State Department of Health. 1961. Upper Genesee River drainage basin. Genesee River Drainage Basin Survey Series Rept. No. 2. 212 p.

The purpose of this survey is to obtain necessary information and data concerning factors in order to properly and intelligently classify and assign standards of quality and purity to waters within the drainage basin. The major biological factor of concern in the survey was the coliform count. Most probable numbers of coliform is included in graphs and charts. Other biological considerations were the populations of fish contained in the lakes and streams of the water-shed and general description of species significant in each area.

442. New York State Department of Health. 1964. Periodic report of the water quality surveillance network 1960 - 1964. New York State Dept. of Health, Albany, N. Y. pp. 1-345.

The objective of collection, processing, storage and reproduction of water quality information is to gain intelligence for specific needs. The water quality surveillance network was established to supply those interested parties with this information for whatever purpose they wish to use it.

This publication presents the parameters of water quality as they are most commonly encountered and used. Selection of specific raw water constituents or parameters for this report is limited to the bacterial, physical, chemical and radiological determinations. The parameters are summarized using measures of central tendency and dispersion respectively expressed as arithmetic mean, median and the maximum and minimum values. The areas sampled included the Lake Ontario watershed.

443. Nicholson, H. Alleyne. 1873. Contributions to a fauna canadensis, being an account of the animals dredged in Lake Ontario in 1872. Canadian Journal. N. S. 13: 490-506.

A series of dredgings were carried out during the summer of 1872 in the vicinity of Toronto. A list containing a description and chief characters of the animals obtained in these dredgings was given. Some of the groups represented were the algae, annelida, arthropoda, mollusca, osteichthys and amphibia.

444. Odell, T. T. 1934. The life history and ecological relationships of the alewife (*Pomolobus pseudoharengus* (Wilson)) in Seneca Lake, New York. Transactions American Fish. Society. 64: 118-126.

Research was done on the life history and ecological relationships of the alewife in order to determine its suitability as a new forage fish in New York State. It is mentioned that the alewife has been landlocked in Lake Ontario for some years and has become abundant there. The majority of the work here was performed in the Finger Lakes in New York.

445. Odell, T. T. 1940. A biological survey of the Lake Ontario watershed. III. Bays and ponds of the shore area. New York State Conservation Dept. Supplemental to 29th Annual Report for 1939. Biological Survey. pp. 82-97.

The more important bays and ponds are discussed with particular reference to the physical, chemical, biological and historical data relating to fish production. Tabulations summarize miscellaneous data and give estimates of relative abundance of fishes. A chart of Irondequoit Bay shows hydrographic data. The general discussion deals with: the stocking policy; the lack of correlation between the fisherman's catch and the relative abundance of certain fishes; migrations of fish to and from Lake Ontario; creel limits; open bays versus closed bays; and the need for further study to determine the best management policy.

446. Ogawa, Roann E. 1969. Lake Ontario phytoplankton, September 1964. Technical Report # 14, Great Lakes Fishery Commission, Ann Arbor, Michigan. pp. 27-38.

Phytoplankton counts on samples collected in Lake Ontario on September 8-18, 1964, showed that green algae were the dominant plankters and diatoms were of secondary importance. The greatest abundance of phytoplankton was close to shore from Toronto, along the southern shore of the lake, and up the eastern shore to the North Channel. The open waters of Lake Ontario were characterized by low numbers of phytoplankton. The relationships among phytoplankton abundance, bottom fauna distribution and enrichment are discussed.

447. Ontario Department of Lands and Forests. 1967. Statistics of the fishing industry in the public waters of Ontario. Ontario Dept. Lands and Forests, Toronto, Ontario. Unnumbered.

Charts on the statistics of the fishing industry in Ontario from 1959-1967. Included is the number of men employed, types of fishing, gear, types of shore installations, monetary value of the industry.

448. Ontario Game and Fisheries Department. 1908a. Ontario fisheries. Ontario Game and Fisheries Department. 1st Annual Report, 1907. pp. 92-97.

Presented here are statistics on the return of the number of fishermen, tonnage and value of tugs, vessels and boats, the quantity and value of all fishing materials by county on Canadian portion of Lake Ontario. Also reported are kinds and quantities of fish caught during the year 1907 listed by county. (Univ. of Toronto, Zoology Library).

449. Ontario Game and Fisheries Department. 1908b. Comparative statement of yield 1906-1907 according to districts. Ontario Game and Fish Department. 1st Annual Report, 1907. p. 99.

Presented here are statistics of the comparison of yield of commercial fish catch by species between 1906 and 1970. (Univ. of Toronto, Zoology Library).

450. Ontario Game and Fisheries Department. 1908c. Comparative statement of yield 1907-1908 according to districts. Ontario Game and Fish Department. 2nd Annual Report, 1908. pp. 101-102.

Presented here are statistics of the comparison of the yield of commercial fish catch by species between 1907 and 1908. (Univ. of Toronto, Zoology Library).

451. Ontario Game and Fish Department. 1909. Ontario fisheries. Ontario Game and Fish Department. 2nd Annual Report, 1908. pp. 94-98.

Presented here are statistics on the return of the number of fishermen, tonnage, value of traps, vessels, boats and tugs, the quality and value of all fishing materials on Lake Ontario by individual county. Also included are kinds and quantities of fish caught during the year 1908 listed by counties and totals of all kinds for Lake Ontario. (Univ. of Toronto, Zoology Library).

452. Ontario Game and Fish Department. 1911a. Ontario fisheries. Ontario Game and Fisheries Department. 1st Annual Report, 1910. pp. 146-165.

Presented here are the statistics on the return of the number of fishermen, tonnage and value of tugs, vessels and boats, quantity and value of all fishing materials by county on the Canadian portion of Lake Ontario. Also reported are kinds and quantities of fish caught during the year 1910 listed by county. (Univ. of Toronto, Zoology Library).

453. Ontario Game and Fish Department. 1911b. Comparative statement of yield for 1908-1909 according to districts. Ontario Game and Fish Department. Annual Report, 1910. pp. 166-169.

Presented here are statistics of the comparison of yield of commercial fish catch by species between 1908 and 1909. (Univ. of Toronto, Zoology Library).

454. Ontario Game and Fish Department. 1912a. Ontario fisheries. Ontario Game and Fish Department. 5th Annual Report, 1911. pp. 152-171.

Presented here are the statistics on the return of the number of fishermen, tonnage, value of tugs, vessels and boats, quality and value of all fishing materials by county on the Canadian portion of Lake Ontario. Also reported are kinds and quantities of fish caught during the year 1910 listed by county. (Univ. of Toronto, Zoology Library).

455. Ontario Game and Fish Department. 1912b. Comparative statement of yield for 1909-1910 according to districts. Ontario Game and Fish Department. 5th Annual Report, 1911. pp. 172-174.

Presented here are statistics of the comparison of yield of commercial fish catch by species between 1909-1910. (Univ. of Toronto, Zoology Library).

456. Ontario Game and Fish. Department. 1945. The era of salmon in Lake Ontario. Monthly Bulletin Ontario Department Game and Fish. 1(2): 9-10.

The article begins by using stories of fishermen to illustrate the vast quantities of salmon found in the Ganaraska River, which flows into Lake Ontario at Port

Hope. The annual slaughter of the salmon brought economic prosperity to the people. This, in turn, brought factories and farming along the banks which fouled and changed the creek from its natural state and made it less capable of affording shelter and spawning, which in the end, resulted in the elimination of the salmon in the streams. (Univ. of Toronto, Zoology Library).

457. Ontario Water Resources Commissiob. 1963. Report on water resources survey, County of Peel. Toronto, Ontario. 204 p.

A survey of the County of Peel was conducted in April and May 1963 to review the water supply and pollution control facilities. The County of Peel is drained mainly by three watersheds; namely, the Credit River, the Humer River and the Etobicoke Creeks, all of which empty into Lake Ontario which forms the southern boundary of the county.

A summary of laboratory results on Lake Ontario is presented in Table I. The biological parameter included is the MF coliform count/100 ml.

458. Ontario Water Resources Commission. 1965a. Water resources survey, County of Frontenac. Toronto, Ontario. 145 p.

The purpose of this report is to examine the conditions of the water resources of the County of Frontenac and indicate action required to ensure maximum use of those resources. The shorelines of Lake Ontario and the St. Lawrence River form the southern boundary of the county. Table 3-8 contains the stream sample results of Lake Ontario and the St. Lawrence River which includes data on coliform/100 ml.

459. Ontario Water Resources Commission. 1965b. Water resources survey of the County of Halton. Toronto, Ontario. 336 p.

The purpose of this report is to examine the condition of the water resources of the County of Halton. Bacteriological examinations were performed on samples from water supplied, streams and outfalls. The membrane-filter technique was used to obtain a direct enumeration of coliform organisms and the results are reported as MF coliform count per 100 ml. Bacteriological counts included MPN total coliform organisms and *E. coli* counts.

460. Ontario Water Resources Commission. 1965c. Water quality survey of Lake Ontario from Toronto to Kingston. Toronto, Ontario. Unnumbered.

This report correlates the results of samples of the waters of Lake Ontario from Metropolitan Toronto's eastern boundary to the City of Kingston and major tributaries thereof in the vicinity of their points of discharge collected during 1962, 1963, 1964 and part of 1965. The biological parameters used for determining levels of pollution were coliform counts. The membrane filter technique was employed to obtain coliform counts which are reported/100 ml.

461. Ontario Water Resources Commission. 1965d. Report on a water quality survey of the St. Lawrence River from Quebec boundary to Kingston. Toronto, Ontario. Unnumbered.

This report attempts to correlate the results of samples of the waters of the St. Lawrence River from the Quebec boundary to the City of Kingston, a distance of 146 miles, and major tributaries. The membrane filter technique was employed to obtain a direct enumeration of coliform organisms, the results of which are reported/100 ml. The MPN index was employed to determine the count of coliform bacteria present in water supplies.

462. Ontario Water Resources Commission. 1965e. Water quality data compiled by River Basin Surveys Water Quality Surveys Branch, Division of Sanitary Engineering, Toronto, Ontario. 1964-1965. Vol. 1. 287 p.

A water quality monitoring program has been established along key rivers and lakes, especially those which are tributaries of Lake Ontario. Data from this sampling station is tabulated year round. Analysis of samples included the following parameter: total coliforms.

463. Ontario Water Resources Commission. 1967. Water quality data 1965-1966. Toronto, Ontario. Vol. II. 364 p.

The data collected is the result of a program to record basic water quality information. Sampling stations were selected at points considered representative of the general condition of the body of water. The information is used to maintain surveillance over water quality and to provide supporting data used in the analysis and prediction of water quality for planning and other purposes. A bacteriological examination of samples was made to determine total coliform parameter.

464. Ontario Water Resources Commission. 1970a. Report on a water pollution survey of the City of Oshawa. Toronto, Ontario. Unnumbered.

During May, 1970, a water pollution survey was made in the City of Oshawa, located on the north shore of Lake Ontario 32 miles east of Toronto; the purpose of the survey being to review the water quality of the drainage courses in the Oshawa area and to locate potential and existing sources of pollution which could adversely affect the ground and surface water quality. The bacteriological examinations utilized the membrane filter technique to obtain a direct count of coliform organisms and included in a table is the data on total and fecal coliform counts.

465. Ontario Water Resources Commission. 1970b. Water pollution survey of the Village of Newburgh, County of Lennox and Addington. Toronto, Ontario. Unnumbered.

Information on the nature of water pollution in the Village of Newburgh and the need for its prevention and control is provided in this report. The quality of water in the Napanee River and streams flowing into the river around Newburgh was assessed. Bacteriological and chemical samples were collected each year at 8 stations shown in the appendix since 1965 and the coliform bacteria count was determined using the Most Probably Number (MPN) and the Membrane Filter Methods. Results show that the total coliform populations were relatively low whereas the fecal coliforms were above the number expected. The overall results over the years, however, were generally satisfactory.

Orban, Edward - See: Willis L. Tressler, No. 559.

Osmond, D. S. - See: M. G. Johnson, No. 299.

Owen, G. E. - See: M. G. Johnson, No. 300, 301.

Owen, G. E. - See: John H. Neil, No. 394.

466. Parker, Arthur C. 1925. Black skimmer on Lake Ontario. The Auk. 42: 441.

A short note on the observation of a black skimmer (*Rynchops niger*) on Lake Ontario near Rochester on September 15, 1924.

Pasko, Donald - See: U. B. Stone, No. 545.

Pasko, Donald - See: Dwight A. Webster, No. 580.

467. Pasko, Donald. 1956. Lake Ontario lake trout. NYS Conservationist. 10(4): 16-17.

The lake trout in Lake Ontario waters have been on the decline since the 1930's. Both sport and commercial laketrout catches were large. In 1879 a record catch of 569,700 lbs. were caught in U. S. waters along, however, recently they have fallen to a very low level. The available information does not lead to the conclusion that overfishing is the sole factor in the decline. The lamprey has been accused decimating the lake trout but the lamprey was present in Lake Ontario for many years, even when the fishing was at its maximum. The smelt may be another factor influencing the lake trout. Smelt may be eating the young lake trout fry. The common eel has also been accused of this. A program of lake trout plantings with fin tagged fry was conducted. Experimental netting by the conservation department indicated that survival is good with a rapid growth rate. The lake trout recoveries have indicated a wide ranging. All the information is presented on a map. Further studies on the lake trout survival growth and movements by use of tagged fish is encouraged.

468. Patalas, K. 1969. Composition and horizontal distribution of crustacean plankton in Lake Ontario. Journal Fish. Research Board Canada. 26: 2135-2164.

The horizontal distribution of planktonic crustaceans was determined in Lake Ontario at monthly intervals from June to October 1967, based on net hauls from 50 to 0 m at 32-62 stations. Most species appeared in the collections during June-July in the eastern part of the lake with abundance patterns later moving westward, contrary to the general movement of wind and water. At the time of maximal population density, there was a strong positive correlation between zooplankton abundance and heat content of the water column from 0 to 25 m. Upwelling was responsible for low numbers of zooplankters along the northwestern shore. Flow from the Niagara River was associated with increased abundance of zooplankters in spring and summer, but decreased abundance in autumn. Temperature and depth of the epilimnion as influenced by the general direction of wind motion were key factors in understanding the zooplanktonic community of Lake Ontario.

469. Patalas, K. 1971. The comparison of crustacean plankton communities of seven North American Great Lakes. Abstract of paper presented at 14th Conference Great Lakes Research. Toronto, Ontario. April 19-21, 1971. pp. 109-110.

A series of vertical hauls were taken during July and August 1967-68 on Lakes Ontario, Erie, Huron, Superior, Winnipeg, Great Slave and Great Bear to characterize their summer plankton communities.

In the Erie and Ontario communities, an intermediate number of species (11-18) was found with cyclopoids and cladocerans dominating.

470. Payne, N. R. 1964. The life history of the walleye, *Stizostedion vitreum* (Mitchell), in the Bay of Quinte. Univ. of Toronto, Dept. of Zoology. MA Thesis. 40 p.

Contained in this report is a description of the life history of the walleye in the Bay of Quinte and Lake Ontario during the six year period 1957-1962. Information on statistics for individual fish, age determination, spawning, maturity, fecundity, growth, length - weight relationships, length-birth relationship, food, migration, age composition and year-class strength is given. (Univ. of Toronto, Zoology Library).

471. Pentland, E. S. 1930. Controlling factors in the distribution of *Gammarus*. Transactions American Fish. Society. 60: 89-94.

The value of *Gammarus*, or fresh-water shrimp, as a food for speckled trout has been recognized for some time and considerable work has been done on their life history and distribution. The present investigation is being carried out to determine the natural distribution of the two species as found in Ontario, the factors which limit this distribution, and the possibility of introducing them into waters, in which they do not now occur, to augment the food supply of the brook trout.

Perkins, R. B. - See: B. G. H. Johnson, No. 297.

472. Piersol, W. H. 1913. XVIII. Amphibia. In: Faull, J. H. (Ed.). The Natural History of the Toronto region, Ontario. Canadian Institute, Toronto. pp. 242-248.

Contains a comprehensive list of amphibia known to occur in the vicinity of Toronto at that time. A total of 19 species are reported. (Toronto-Royal Ontario Museum).

Pope, T. E. B. - See: Carl L. Hubbs, No. 266.

Popplow, J. - See: B. J. Dutka, No. 141, 142.

Power, E. A. - See: A. W. Anderson, No. 5.

Power, G. - See: A. N. Sheri, No. 513, 514, 515, 516.

473. Powers, Charles F. and Andrew Robertson. 1966. The aging Great Lakes. Scientific American. 215(5): 94-100, 102, 104.

The five Great Lakes in the heartland of North America constitute the greatest reservoir of fresh water on the surface of the earth. Like all other lakes, they are subject to physical and biological processes that will eventually result in their extinction. The Great Lakes are comparatively young and their natural aging would not be a cause for present concern since the natural processes proceed at the slow pace of the geological time scale. The aging of these lakes is now being accelerated tremendously, however, by man's activities.

Pritchard, Andrew L. - See: J. R. Dymond, No. 149.

474. Pritchard, Andrew L. 1928. A preliminary study of the genus *Leucichthys* in the Canadian waters of Lake Ontario. Univ. of Toronto Studies, Biological Series No. 31. pp. 7-25. (Publications of the Ontario Fisheries Research Laboratory, No. 32).

The freshwater fishes of the genus *Leucichthys* are popularly known as lake herring or ciscoes. At the present time, there are four species of this genus in Lake Ontario - *L. artedi*, *L. reighardi*, *L. kiyi* and *L. hoyi*. Each of these four species inhabits a definite range of depths. *L. artedi* has a wider range than the others, going from about 10 to 400 feet, but being most numerous at depths of less than 150 feet. The optimum depth for each of the other species is as follows:

L. reighardi 250 feet, *L. hoyi* 275 feet, *L. kiyi* 400 feet to deeper.

The species differ in the quality of their flesh, the fisherman dividing them into herrings and ciscoes. Ciscoes are deep water fish with fat or oily flesh and include *L. reighardi*, *L. kiyi* and some of the fatter individuals of the species *L. hoyi*. Herrings are shallow water fish with a dry or less oily flesh, viz *L. artedi*.

A complete description of each species is given followed by a discussion of racial differences. Also included is a section on the relation of mesh nets to size of fish taken.

475. Pritchard, A. L. 1929. The alewife (*Pomolobus pseudoharengus*) in Lake Ontario. Publication of the Ontario Fisheries Research Laboratory No. 38. pp. 37-54. (Univ. of Toronto, Biological Series No. 33).

This study was directed chiefly toward obtaining information as to food, rate of growth and interrelationships with other species of fish such as Lake trout, burbot, eel, whitefish and ciscoe. The material examined was procurred from nets set of Port Credit in the summer of 1927 and Bay of Quinte in 1928. Comparisons were made between alewives from the Atlantic coast and those in Lake Ontario. A history of the alewife, its identifying characteristics, spawning and economic aspects is also included.

476. Prichard, Andrew L. 1931a. Taxonomic and life history studies of the ciscoes of Lake Ontario. Univ. of Toronto Studies, Biological Series No. 35. Publication of the Ontario Fisheries Research Laboratory No. 41. 78 p.

The ciscoes are an important group of freshwater fishes, characteristic of the larger lakes of the northern parts of North America, Asia and Europe. In all these regions, but more especially in Canada, they are of considerable economic importance, and in common with many others of our commercial species, measures for their conservation are being sought.

Because in most lakes, there are several species, each differing from the others in such respects as habit, habitat, size attained, quality of flesh and time of spawning, an understanding of the steps necessary for their protection is more difficult then in the case of many other fishes. The studies reported in the present paper had as their object the discovery of such information for the species of this group in Lake Ontario.

Included in the paper is the history of the ciscoe fishery, description of the different species, origin of the Lake Ontario ciscoes, food studies, spawning characteristics, parasites and enemies of the ciscoe.

477. Pritchard, Andrew L. 1931b. Spawning habits and fry of the cisco (*Leuchichthys artedi*) in Lake Ontario. Contributions Canadian Biology and Fisheries, N. S. 6(9): 225-240.

The spawning habits of the cisco (*Leuchchthys artedi*) and the fry were studied in the Bay of Quinte, Lake Ontario. It was found that the cisco spawns during the last two weeks of November and in December. The eggs are deposited in crevices of the rocks in water from 2 1/2 - 3 meters deep. They hatch in late April and early May, the period of incubation depending on temperature and other conditions. The fry are found schooling with the whitefish in shallow, protected bays until they are about a month old, when they disappear. Fry commence to feed when about ten days old, their food consisting chiefly of algae, copepods and cladocerans.

478. Radcliff, Lewis. 1929. Status of the Great Lakes Fisheries. Transactions American Fish. Society. 59: 45-52.

In the days of the early settlers, the Great Lakes were well stocked with fish of most excellent quality. Concern has developed over the sharp declines which American and Canadian fishermen have experienced between 1913 and 1925. It is recommended that the needs of the Great Lakes fisheries be studied so that based on the knowledge obtained, a series of regulations could be made to conserve the fisheries. (Canada Centre for Inland Waters).

479. Radforth, Isobel. 1941. Some consideration on the distribution of fishes in Ontario. Univ. of Toronto, M. A. Thesis, Dept. of Zoology. 119 p.

This paper attempts to describe the distribution and offer feasible explanations for the dispersal of Ontario fishes. Included are distributional maps for 42 species, 31 of which occur in Lake Ontario.

It was found that for the most part, the species of Ontario fishes may be placed in groups depending on the nature of their occurrence in Ontario waters. Several of these groups, as well as some individual distributional problems are discussed. (Univ. of Toronto, Zoology Library).

Rand, Myrton C. - See: Daniel F. Jackson, No. 293.

480. Raney, Edward C. 1947. Subspecies and breeding behavior of the cyprinid fish, *Notropio procne* (Cape). Copeia. 2: 103-109.

The northern swallowtail shiner, *Notropis procne procne* (Cape) is a small species that apparently reaches its northern limit in Catherine Creek, in the Lake Ontario drainage system. It is also found in the Delaware and Susquehanna of New York and ranges southward in Atlantic Coast streams.

A key to the subspecies appears in the article with which the author examines the subspecies throughout the range described above. The paper also includes a discussion on sexual disnorphisma, breeding behavior and the life of the fish.

481. Raney, Edward C. and Ernest A. Lachner. 1943. Age and growth of Johnny darters, *Boleosoma nigrum olmstedi* (Storer) and *Boleosome longimanum* (Jordan). American Midland Naturalist. 29(1): 229-238.

In this study, the scale method was used to elucidate some of the main features of the life histories of two species of small percid fishes - *Boleosome nigrum olmstedi* and *Boleosome longimanum*. The study was based on 845 specimens of *B. nigrum olmstedi* taken in tributaries of the upper Susquehanna River system near Candor, in Lake Ontario at Fair Haven Bay, and in Oneida Lake, N. Y. and on 102 specimens of *B. longimanum* collected in tributaries of the upper James River system in Virginia.

Determination of age, longevity and growth rates are discussed.

482. Rathbun, Richard. 1895. Report upon the inquiry respecting food-fishes and the fishing grounds. U. S. Commission Fish and Fisheries. Report for 1893. Part 19. pp. 17-51.

Included in this article is a section on the "mortality among alewives, Lake Ontario." The mortality that occurs among the alewives in Lake Ontario during every spring and summer is discussed. Examination of the diseased fish revealed a patch of *Saprolegnia* approximately 3/4 - 1" in diameter, but the cause of the epidemic was not confirmed.

Regier, Henry A. - See: Robert G. Ferguson, No. 166.

Reid, John E. - See: Bernard J. Dutka, No. 143.

Reid, John E. - See: A. D. Tennant, No. 550.

483. Reighard, Paul. 1908. A plan for promoting the whitefish production of the Great Lakes. Bulletin U. S. Bureau Fisheries. 28 (Part 1): 643-684.

The possible modes of increasing the production of whitefish in the Great Lakes are discussed and the conclusion reached that under existing conditions there are but two modes available, planting of whitefish fry and restrictive legislation. The problem is this a statistical one, that of determining by the study of existing statistical data the effect on the whitefish catch of the lakes by planting whitefish fry and by various forms of restrictive legislation.

The habits of the whitefish are discussed, with the conclusion that the fish is a bottom feeder, restricted in its range during nine months of the year to waters of very definite depth. The depths assigned by investigators to the whitefish are then tabulated for each of the Great Lakes, the areas showing these depths are charted, and the extent of these areas measured in square miles. The whitefish areas as thus defined are then briefly described for each lake. Evidence is then adduced to show that the whitefish are local in their habits, so that each part of each area supports its own group of fish, which are in large measure confined to the area, leaving it only in fall when going inshore to spawn and in spring or summer for about two months.

In studying the relation of the plant of whitefish fry to the catch it is found that, in general, in those lakes or parts of lakes where there has been a large and intensive plant of whitefish fry (30,000 sq.mi.) there has been a correlated increase in the catch of whitefish (72%); in those lakes or parts of lakes in which there has been a moderate plant of whitefish fry (10,000 sq.mi.) there has been a slight increase in the catch of whitefish or the catch has remained nearly constant; in those lakes in which there has been a small plant of whitefish fry (2,000/sq.mi.) or no plant, there has been a reduction in the catch of whitefish (26%).

The effect of legislation on whitefish production is discussed and conclusions drawn.

484. Reineche, Ottomar. 1912. Personal observations and notes on breeding, migrant or visiting birds on the Niagara Frontier. Bulletin Buffalo Society Natural Science. 10: 513-546.

Included is a list with notes on observations and distribution of birds in Western New York, including water birds in the Niagara River.

485. Reinward, Jerry F. 1969. Planktonic diatoms of Lake Ontario. Technical Report # 14, Great Lakes Fishery Commission, Ann Arbor, Michigan. pp. 19-26.

The major species of diatoms in surface collections from Lake Ontario in September, 1964 were *Asterionella formasa*, *Fragilaria crotonensis* and *Tabellaris fenestrata*. The diatom flora in surface collections varied among several stations in the eastern end of the lake.

Comparisons for lakewide diatom populations were made according to three strata of water: "surface" included all samples to a depth of 5 meters; "intermediate" which included samples from 9-45 meters; and "bottom" which included collections from 90-220 meters. Diatoms were examined at 970X with oil immersion lens and counted by a row 159 u wide across a coverslip.

Diatom numbers were low throughout the lake during September 8-18, 1964. Highest counts in collections occurred at intermediate depths. Diatoms were generally more abundant near the shore.

486. Robertson, A. D. 1913. XXI. Mollusca. In: Faull, J. H. (Ed.). The Natural History of the Toronto Region, Ontario. Canadian Institute, Toronto. pp. 288-294.

Contains a list of 75 species of mollusks which occur in the vicinity of Toronto. (Toronto-Royal Ontario Museum).

Robertson, Andrew - See: Sharon C. Czaika, No. 128.

Robertson, Andrew - See: Charles F. Powers, No. 473.

487. Robertson, Andrew. 1966. The distribution of Calanoid copepods in the Great Lakes. Univ. of Michigan, Great Lakes Research Division. Proceedings 9th Conference, Great Lakes Research. Pub. 15: 129-139.

The geographical distribution of the ten calanoid copepods in the Great Lakes has been studied through a synthesis of the previously published identifications with a limited number of original determinations. Six species, *Diaptomus ashlondi, D. minutus, D. oregonensis, D. sicilis, Epischura lacustris* and *Limnocalonus macrurus*, have been found in all the lakes. *Senecella calanoides* has been found in all lakes but Erie; *Eurytencora affinis* in Lake Ontario, Erie and Michigan; *D. siciloides* in Ontario and Erie and *D. reighardi* only in Erie. Two of the species that occur in all the lakes, *D. sicilis* and *L. macrurus* are more abundant in the northern lakes; the inverse is true of *D. oregonensis*. The relative abundances of diaptomids in Lake Michigan in 1964, in Lake Michigan in 1954-55 and in Lake Erie in 1956-57 were compared. This showed that *D. oregonensis* was relatively more abundant in Lake Erie in 1956-57 and *D. sicilis* in Lake Michigan in 1954-55. The season of maximum abundance of a species was generally earlier in Lake Erie in 1956-57 than in Lake Michigan in 1954-55. The conditions in Lake Michigan in 1964 were intermediate in both these respects.

488. Robertson, Imogene C. S. and C. L. Blaheslee. 1948. The mollusca of the Niagara Frontier region and adjacent territory. Bulletin of the Buffalo Society of Natural Sciences. 19(3): 185.

A systematic account of the species of mollusca of the Niagara Frontier Region is listed including species of Lake Ontario and the Niagara River. The list is compiled from records of collections made between 1936 and 1946 and supplemented by records from earlier research and records. Descriptions of the mollusca, areas collected and photographs of the shells are included.

489. Robson, John T. 1878. California salmon in Lake Ontario. Forest and Stream. 10: 482.

This is an account of the evidence of the success of Wilmots experiment involving the introduction of the California salmon (*Salmo quinnat*) in Lake Ontario. A description of two salmon which were taken near New Castle, Ontario is included.

490. Rodd, J. A. 1919. Cooperation. Canadian Fisherman. 6(4): 103-104.

This article is an address by J. R. Rodd, Dominion Superintendent of Hatcheries, Ottawa delivered to the Lake Erie Fisherman's Association. It mentions that the season of 1918 was successful from the standpoint of cooperation, good prices and the amount of fish produced.

With reference to Lake Ontario the collection of whitefish eggs amounted to 148,990,000 in 1917 and 171,800,000 in 1918 for the Bay of Quinte area. (Univ. of Toronto Main Library).

491. Rodd, J. A. 1929. Fish hatcheries are worth while. Canadian Fisherman. 16(7): 19, 31.

Cites the fish cultural problems receiving the attention of the scientific division and the progress being made.

The only mention of Lake Ontario is concerning the investigation into the life history of the ciscoes of Lake Ontario, including their natural habitat, food, growth, etc. (Univ. of Toronto Main Library).

492. Rodd, J. A. 1934. Report of the Committee on Foreign Relations. Transactions American Fish. Society. 64: 20-23.

Some of the treaties and agreements between the United States and other countries concerning fisheries in the boundary waters are discussed. In the discussion, an agreement concerning Lake Ontario between New York State and the Province of Ontario was mentioned in relation to other agreements concerning the Great Lakes and other boundary waters.

493. Rodgers, G. K. 1963. Lake Ontario data report, 1960. Great Lakes Institute, Univ. of Toronto. PR10: 18.

The C.M.S. Porte Dauphine cruised the Great Lakes obtaining limnological, meteorological data and also information on the number of coliform bacteria. This contaminant has public health and water usage significance. (Canada Centre for Inland Waters).

Roecher, Robert M. - See: U. B. Stone, No. 545.

494. Rolan, R. G. 1970a. The phytoplankton, phytobenthos and phytoperiphyton of the Great Lakes. Contribution to the Great Lakes Basin Commission's Framework Studies, Ann Arbor, Michigan. 91 p. (Unpublished).

The Great Lakes flora discussed in this paper include the phytoplankton, phytobenthos and the phytoperiphyton only. The terrestrial and semi-terrestrial plants of the region are not included. Factors taken up in the paper include algae blooms, floral gradients in the Great Lakes, trophic relations, seasonal changes in the algae and factors which control the growth and abundance of algae.

495. Rolan, R. G. 1970b. The zooplankton, zoobenthos and periphytic invertebrates of the Great Lakes. Contribution to the Great Lakes Basin Commission's Framework Studies, Ann Arbor, Michigan. p. 283. (Unpublished).

The zooplankton and zoobenthos of the Great Lakes are of interest to planners and policy makers primarily as indicators of environmental quality and as intermediate members of aquatic food webs upon which fisheries and many waterfowl depend. The literature on the invertebrates of the Great Lakes is extensive, but this review reveals numerous and rather significant gaps of knowledge. This paper deals with the components of the fauna; the use of zooplankton and zoobenthos as indicators of environmental conditions in the lakes; feeding and reproduction and seasonal patterns in population fluctuations.

496. Saunders, George W. 1964. Studies of primary productivity in the Great Lakes. Univ. of Michigan, Great Lakes Research Division. Proceedings 7th Conference Great Lakes Research. Pub. 11: 122-129.

Data concerning photoysnthesis in the Great Lakes are very scanty. There have been only two research programs which have dealt directly with photosynthesis in the

Great Lakes. One of these programs attempted to gain some insight as to the distribution of photosynthesis in western Lake Erie. The other program attempted to develop and evaluate a shipboard method for estimating photosynthesis. Some additional inference concerning photosynthesis can be made using known concentrations of chlorophyll to calculate photosynthesis are very broad and therefore interpretation is somewhat tenuous. When results for calculated photosynthesis using all methods are compared, two points are apparent: (1) the range of photosynthetic activity in all lakes is very large and (2) western Lake Erie is very different from the other Great Lakes. It is more productive than many smaller lakes which are considered to be highly productive.

The Great Lakes are important as a natural resource and as basins in which controlled experiments can be performed. Perhaps the very paucity of data indicates the exciting future which lies ahead for those individuals who study photosynthesis and other biotic events in these large lakes.

497. Scadding, Henry. 1873. Toronto of old: Collections and recollections illustrative of the early settlement and social life of the capital of Ontario. Adam, Stevenson and Co., Toronto. 594 p.

A general description of the history of Toronto. Included is mention of plentiful salmon for spearing in the streams and the large numbers of waterfowl present in the Toronto Harbor at its founding.

498. Schenk, C. F. and R. E. Thompson. 1965. Long-term changes in water chemistry and abundance of plankton at a single sampling location in Lake Ontario. Univ. of Michigan, Great Lakes Research Division. Proceedings 8th Conference Great Lakes Research. Pub. 13: 197-208.

Evaluation of data accumulated at the Toronto Island Filtration Plant from 1923 to 1954 indicated that the level of plankton approximately doubled during this period. Coincidentally, increasing levels of free ammonia, chlorides, hardness and turbidity were experienced and these continued to increase up to 1964. Turbidity levels and concentrations of free ammonia in the "raw" water were substantially greater than results obtained farther out in the lake. The mean increase of plankton was computed at 5.6 areal standard units per annum. Well-defined spring maximum and winter minimum populations were apparent nearly every year, but fall maxima developed inconsistently and were characterized by lower levels of abundance than the spring pulses.

Schroder, G. D. - See: M. W. Fenlon, No. 165.

499. Scott, W. B. 1956. The smelt in Ontario. Division of Zoology and Paleontology, Royal Ontario Museum, Toronto. 7 p. (Unpublished).

Contains a brief discussion of the smelt in the lakes of the Province of Ontario including information on the spread of smelt through the Great Lakes, food, methods used for capture and economic importance. (Univ. of Toronto, Zoology Library).

500. Scott, W. B. and W. J. Christie. 1963. The invasion of the lower Great Lakes by the white perch, *Roccus americanus* (Gmelin). Journal Fisheries Research Board Canada. 20(5): 1189-1195.

Roccus americanus (Gmelin) has become part of the Lake Ontario - St. Lawrence River fauna, originating from populations in Upper New York State. The time required for the species to spread through the lower Great Lakes is discussed and summarized. A review of the morphological distinctions of related species is included.

501. Scudder, Charles W. 1896. List of publications of the United States Commission of Fish and Fisheries from its establishment in February, 1871 to February, 1896. U. S. Commission Fish and Fisheries, Report for 1894. Part 20, App. 10: 617-706.

The above is an index of the publications of the United States Commission of Fish and Fisheries from 1871 to 1876. The index is divided according to "Annual Reports," "Bulletins," and "Fishery Industries of the U. S." The list of papers published are indexed according to author and subject.

502. Seeber, E. L. 1949. Observations on American brant along the Niagara River. Prothonotary, 15(11): 71.

This paper is a short account of the observation of an American Black Brant (*Branta gernicla nigricans*) in the Niagara River on November 13, 1949.

503. Seeber, E. L. 1950. Black headed gull. Prothonotary. 16(1): 5-6.

A short description of the observations of an immature black headed gull on December 26, 1949 on the Niagara River.

504. Seeber, E. L. 1951. Ontario-North of the Falls. Prothonotary. 17(8): 49.

A list of waterfowl observation points along the Ontario side of the Niagara River and Lake Ontario is presented.

Senning, W. C. - See: C. W. Greene, No. 221.

505. Senning, W. C. 1940. A biological survey of the Lake Ontario watershed. IV. Lake and ponds above the Lake Ontario lake level. New York State Conservation Dept., Supplemental to 29th Annual Report for 1939. Biological Survey. pp. 98-116.

Studies were made in 69 lakes and ponds in the Lake Ontario drainage. This number includes all the lakes and ponds of any importance open to public fishing. There are relatively few natural ponds in the area. Artificial quarry ponds provide the major pond fishing west of Rochester. Each survey study comprised a chemical analyses of the water, a census of fish species, lake soundings and temperature readings, and miscellaneous observations on spawning areas, forage, vegetation, types of bottom, success of past stocking and fishing history. Based on the data compiled, a stocking policy believed to be consistent with existing conditions has been formulated. Excepting the reservoirs in the Salmon River, there is little trout water in the ponds of the area. The pond studies indicate that, except in a few instances, natural spawning is adequate for the warm-water species and little stocking is necessary. In general, the forage problem is not acute. Only in a few, mainly in the quarry ponds, is forage inadequate. The outstanding limiting factor in game fish production appears to be the chemical nature of the water. Only a few ponds had sufficient oxygen in the deeper waters to support fish life. There is a need for basic studies directed toward solving problems not of a stocking nature since increased stocking is obviously not the solution of all lake and pond ills.

506. Sheppard, R. W. 1937a. Forster's tern on the Niagara River. The Auk. 54: 205-206.

While traveling along the Niagara River Boulevard on October 19, 1936, the author sighted about 12 tern in several small scattered parties.

507. Sheppard, R. W. 1937b. The American eider on the Niagara River. Canadian Field-Naturalist. 51: 59.

On November 21, 1936, a young male American Eider (*Somateria molissima dresseri*) was taken off the south end of Navy Island about midway in the channel between that island and the Canadian shore by a hunter. It was one of three that had been in the area.

508. Sheppard, R. W. 1937c. The American egret at the eastern end of the Niagara peninsula. Canadian Field Naturalist. 51: 125-126.

While visiting a measuring weir on a feeder waterway close to the Welland ship canal at Allanburg on July 27, 1937, the writer observed seven American Egrets (*Casmerodius albus egretta* Gmelin).

509. Sheppard, R. W. 1945. Water birds of the Niagara. A history and list of aquatic bird-life on the Niagara River. Canadian Field Naturalist. 59(5): 151-169.

Included in this study is a review of the literature of the aquatic bird life in the Niagara River. A list of waterfowl and shorebirds of species found in the Niagara River covering seasonal occurrence, distribution and observations and general notes is presented.

510. Sheppard, R. W. 1951. The Athabaska Canada Goose on the Niagara River. Canadian Field Naturalist. 65: 114.

A flock of geese comprising 23 Canada Geese, *Branta canadensis* subsp. and one adult Blue Goose, *Chen coerullscens* was sighted on March 17, 1950 near the point which was formerly the mouth of the Welland River.

511. Sheppard, R. W., W. E. Hurlburt and G. H. Dickson. 1936a. A preliminary list of the birds of Lincoln and Welland Counties, Ontario. Canadian Field Naturalist. 50(6): 95-103.

Presented here is an annotated list of birds from these Niagara peninsula counties. Included are reports on waterfowl observed in the Niagara River and Lake Ontario. Areas of distribution locally for these species is noted.

512. Sheppard, R. W., W. E. Hurlburt and G. H. Dickson. 1936b. A preliminary list of the birds of Lincoln and Welland Counties, Ontario. Canadian Field Naturalist. 50(8): 131-140.

This report is a continuation of the report in Canadian Field Naturalist 50(6). Presented here is an annotated list of bird species found in Lincoln and Welland Counties. Included is information on the gulls and terns observed in the Niagara River and Lake Ontario. Notes on abundance and distribution are included.

513. Sheri, A. N. and G. Power. 1968. Reproduction of white perch, *Roccus americanus*, in the Bay of Quinte, Lake Ontario. Journal Fisheries Research Board Canada. 25(10): 2225-2231.

This note reports on the age and size at maturity, sex ratios, spawning season and fecundity of white perch *Roccus americanus*, inhabiting the Bay of Quinte area of Lake Ontario.

Results show that the reproductive performance of white perch in the Bay of Quinte is similar to that elsewhere in the range.

514. Sheri, A. N. and G. Power. 1969a. Fecundity of the yellow perch, *Perca flavescens* Mitchell, in the Bay of Quinte, Lake Ontario. Canadian Journal Zoology. 47(1): 55-58.

The relationships between the logarithm of the number of ova shed by yellow perch in the Bay of Quinte and length, weight and age of the fish were found to be: $Y = 2.892 + 0.007 X$ where X is length in millimeters; $Y = 3.769 + 0.004 X$ where X is weight in grams; $Y = 3.780 + 0.098 X$ where X is the age in completed years. The logarithm of the number of mature ova spawned = 4.082 + 0.003 multiplied by the ovary weight in grams. Individual fecundity ranged from 3035 for a II+fish, 135 mm, 27.2g to 61 465 for a VIII+fish, 257 mm, 308.4g.

515. Sheri, A. N. and G. Power. 1969b. Ammulus formation on scales of the white perch, *Morone americanus* (Gmelin) in the Bay of Quinte, Lake Ontario. Transactions American Fish. Society. 98(2): 322-326.

White perch invaded Lake Ontario about 1950 and have since become very abundant in the Bay of Quinte. In a study of the species' growth during the period of colonization, scales from 4,168 white perch were used for age determination. It was observed that the annulus was formed quite late in the year, and that fish with the same number of annuli belonged to the same year class regardless of how many circuli followed the last annulus.

516. Sheri, A. N. and G. Power. 1971. Annulus formation on scales of the white perch, *Morone americanus* (Gmelin) in the Bay of Quinte, Lake Ontario. Transactions American Fish. Society. 98(2): 322-326.

White perch invaded Lake Ontario about 1950 and have since become very abundant in the Bay of Quinte. In a study of the species growth during the period of colonization, scales from 4,168 fish caught between 1958 and 1966 were used for age determination. It was observed that the annulus was formed quite late in the year, an important consideration when estimating fish growth.

517. Sibley, C. K. 1931. Fish food studies. NYS Conservation Department. Supplemental 21st Annual Report for the Year 1930. Biological Survey. 6: 120-132.

During the summer of 1931 fish food studies were made in Black Lake, Cranberry Lake, Black River Bay, Chaumont Bay, Chippewa Bay, Morristown Bay and French Creek. The purpose of the study was to determine the numbers and lands of bottom animals suitable for food and to study the stomach contents of fish. Included in the paper is productivity estimated in pounds per acre for Black River Bay, a list of predaceous species with the fish food found in their digestive tracts and a summary of fish foods.

Simpson, R. W. -- See: G. E. Symons, No. 547.

518. Skiff, J. V., D. H. Weeks and U. B. Stone. 1950. Lake Ontario. New York State Conservationist. 4(4): 7-10.

Presented in this paper is a history of Lake Ontario with an emphasis on the fisheries of the lake. The Atlantic salmon was the first fishery resource to be exploited and the salmon was extinct by 1900. Scale analysis indicated these salmon were landlocked and never went to sea. The next fish species to be utilized were the ciscoes and lake trout. The bloater, a deep water cisco, was extensively fished from 1875-1895, and is now extinct. Presently, the fishery industry is supported by about a dozen species consisting principally of blue pike, cisco, whitefish and yellow perch. The principal fishing ports are Youngstown, Wilson, Sodus Point, Oswego, Selkirk and Cape Vincent. In Chaumont Bay, an interesting specialized fishery has grown up employing mostly small trap nets in which a large quantity of bullheads, eels, suckers, carp, sunfish, and perch are taken. It is thought the removal of these fish helps the black bass sport fishery by removing the fish competing for its food. The principal method of commercial fishing is the use of the gill net. The sport fishing in Lake Ontario is comprized mainly of black bass, yellow perch and blue walleye. In the bays, walleye, northern pike and pan fishes are important.

519. Smith, Hugh M. 1892. Report on an investigation of the fisheries of Lake Ontario. Bulletin U. S. Fish Commission for 1890. 10(Art. 6): 177-215 + plates.

The information presented includes a brief account of the physical characteristics of the lake as far as they may have an influence on the fish and fisheries; statistics showing the extent of the commercial fisheries in each county on the lake, with a consideration of the present and past importance of the lake fisheries; an exhibition of the extent of the import trade in Canadian fish, with a discussion of the same; remarks on certain fishes of economic importance; and a suggestion of the steps necessary for the improvement of the fisheries.

The principal commercial fishes of Lake Ontario are discussed primarily from an economic standpoint, although some information concerning their habits and movements is introduced which is thought to add something to the knowledge of the fish life of the lake. Approximately 26 species are discussed.

520. Smith, Hugh M. 1895. Notes on two hitherto unrecognized species of American whitefishes. Bulletin U. S. Fish Commission for 1894. 14: 1-13.

Within this article is a section entitled "Notes on the natural history and economic value of *Coregonus prognathus*, with special reference to Lake Ontario. The notes are based on original observations and inquiries on the habits and importance of this fish. A discussion of the common names, length, weight, bathymetrical migration, spawning and food habits is given. Regarding the economic value, the approximate yield of this fish in 1891 was 250,000 pounds with a value of $8,100. In comparison, catch of the regular whitefish was 15,000 pounds with a value of $7,000.

521. Smith, Hugh M. 1896. Report of the Division of Statistics and Methods of the fisheries. U. S. Commission of Fish and Fisheries. Commission Report for 1895. pp. 93-103.

This report describes the extent of the fisheries of the Great Lakes. It also includes comparative statistics of the Great Lakes fisheries for the year 1880, 1885, 1889 and 1893. In Lake Ontario, in 1893, the condition of the fisheries was very poor. A marked decrease occurred in every important fish. The most important reason for this decline has been the depletion of the lake's fishery resources.

522. Smith, Hugh M. 1907. Our fish immigrants. National Geographic. 18(6): 385-400, 4 plates.

A discussion of the transplanting of native aquatic animals into waters in which they are not indigenous and the introduction of fishes of foreign countries into the U. S. is presented.

With reference to Lake Ontario, a case of accidental or unintentional acclimatization is that of the alewife which found its way from the Delaware and Hudson River into Lake Ontario and became excessively abundant. It is a stunted race of seemingly no economical value and is also subject to periodic kills which pile on the shores and pollute the water.

In 1771 the colony of New York considered transplanting salmon from Lake Ontario or neighboring rivers to the Hudson but did not go through with it. Carp is discussed in the Great Lakes but no specific mention is given to Lake Ontario.

523. Smith, Hugh M. and M. M. Snell, 1891. U. S. Commission Fish and Fisheries. Commission Report for 1887, Part 15. pp. 296-328.

This report for the year 1887 includes a general description of the lake, the histroy and present condition of the lake, a list of localities where assorted nets are used, a description of the men who are fishermen and a list of the fish that are caught in the lake. The fish trade is also discussed with a general statistical summary of the persons employed in the fisheries of Lake Ontario in 1885 (by counties). Also described are the various nets which are employed and the type of fish caught in them compiled in tables according to county. Also included are descriptions of the shore characteristics and the fishing in the counties which border the lake on the American side.

524. Smith, Lester, 1936. Observations on natural versus artificial propagation of commercial species of fish in the Great Lakes Region. Transactions American Fish. Society. 66: 56-62.

Presented here is a comparison of artificial versus natural propagation of commercial fish species in the Great Lakes. As a means of continued high commercial catches, the author defends the idea of artificial supplementing of the natural stocks and his reasons are listed. (Canada Centre for Inland Waters).

525. Smith, Standord H. 1956. Limnological surveys of the Great Lakes - early and recent. Transactions American Fish. Society. 23: 409-418.

Early explorations on the Great Lakes were concerned largely with things easily collected or observed - common organisms, water levels, surface temperatures... Even when more scientific studies were undertaken, they were at first scattered and small-scale. Effective surveys became possible only through inter-agency cooperation which permits a pooling of facilities, staff and equipment. Expansion of limnological research on the Great Lakes has been reaped in later years and the outlook for the future is good.

526. Smith, Stanford H. 1968a. That little pest the alewife. Limnos. 1(2): 12-20.

The alewife is a fairly recent introduction and has become a serious problem in some of the Great Lakes. When the large native predators were reduced almost to extinction in the lakes, the alewife reproduced at almost unbelievable swiftness resulting in huge numbers of this single species; alewives were probably controlled by the large predators. Alewives commonly have massive die offs in the spring and many theories have been put forth to explain this. They include the idea that the alewife has difficulty with temperature changes and adjustment resulting in death. Other ideas include thyroid deficiency, toxins from blue green algae, starvation and fungus infections. The life cycle of the alewife is discussed. Lake Ontario is used as an example of what happens to a lake long dominated by the alewife. The present alewife fishery along with means of controlling alewife populations is presented. The need for research into the alewife problem and rehabilitation to lakes infested by it are discussed. The alewifes life cycle and general seasonal movements are presented.

527. Smith, Stanford H. 1968b. Species succession and fishery exploitation in the Great Lakes. Journal Fisheries Research Board Canada. 25(4): 667-693.

The species composition of fish in the Great Lakes has undergone continual change since the earliest records. Some changes were caused by enrichment of the environment, but others primarily by an intensive and selective fishery for certain species. Major changes related to the fishery were less frequent before the late 1930's than in recent years and involved few species. The successive collapses of various stocks after periods of stable production may give some indication of their sustained yield. Fish stocks are in a state of extreme instability in Lakes Superior, Michigan, Huron. Careful stocking programs and fisheries and coordination of management among the various states of the United States and the Province of Canada (Ontario) which manage the fish stocks, will be required to restore and maintain a useful fishery balance.

528. Smith, Stanford H. 1969. Environmental changes in the fisheries of the Great Lakes region. In: A. Dean, S. P. Hart, J.A. Jones (Ed.). Proceedings of the Conversation in the Discipline of the Economic and Social Impact of Environmental Changes in the Great Lakes Region. State University College, Fredonia, New York. pp. 9-35.

During a period of little more than a century, the Great Lakes fish populations have changed from a mature stage of ecological succession characterized by high stability and productivity to a system characteristic of a very early stage of succession that is unstable, inefficient and unproductive. In the thousands of years that followed, glacial retreat from the Great Lakes region an interacting system of fish species developed and became abundant in all ecological niches of the lakes. Under the present system there are few dominant species and poorly organized fish communities in which many niches are incompletely occupied. The ecological conditions of the lakes are changing at an increasing rapid pace. Native fish that become adapted to the lakes over thousands of years could not accommodate to the change, and in the lower lakes where water quality has been affected the most, all of the previously abundant and desirable species have been greatly reduced and some have vanished. Now the yellow perch, smelt and white bass which were once classified as second or third rate species support the troubled fishery and sheepshead, carp and goldfish dominate the lake and its bays.

The paper includes the changes in the Great Lakes fishery from 1873 to present. Fish populations mentioned are: salmon, trout, whitefish, lake herring, blue pike, sauger, walleye, alewives, yellow perch, American smelt, lake sturgeon, chuls and burbots.

529. Smith, Stanford, S. H. 1970a. Trends in fishery management of the Great Lakes. Transactions Americah Fish. Society. Special Publication 7(48): 107-114.

Some hope is returning for recovery of the fish stocks of the Great Lakes, which have been outstanding examples of abuse. The lakes and the fish in them have been under complete jurisdiction of sovereign nations, but ironically this control has not prevented their decadence. Although fishery managers representing the states and province have at various times agreed upon and fastered joint management plans, at no time have legislatures acted in unison to permit compatible management.

530. Smith, Stanford H. 1970b. Species interactions of the alewife in the Great Lakes. Transactions American Fish. Society. 99(4): 754-764.

The alewife (*Alosa pseudoharengus*) has caused serious problems in the Great Lakes for almost 100 years. It entered Lake Ontario in abundance via the Erie Canal during the 1860's when major piscivores were declining, and became the dominant species in the lake during the 1870's. The alewife subsequently spread throughout the Great Lakes and became the dominant species in Lakes Huron and Michigan. In lakes where it became extremely abundant, the shallow-water planktivores declined in the first decade after alewife establishment, the minor piscivores increased then declined the second decade, and the deep-water planktovores declined in the third decade. The consequence has been a general reduction of the alewife and restoration of an interacting complex of deep and shallow water forage species, and minor and major prscivores, either by re-establishing species affected by the alewife, or by the introduction of new species that can thrive under the new ecological conditions of the lakes.

Snell, M. M. - See: H. M. Smith, No. 523.

531. Snyder, J. P. 1932. Tagged smallmouth black bass in Lake Ontario, New York. Transactions American Fish. Society. 62: 380-381.

In early July, 1931, at the newly completed bass ponds at the Cape Vincent station, N.Y., 150 bass were tagged before being released. The tags were fastened to the upper, thick portion of the gill cover. Nineteen fish reported to have been caught by fishermen. This was repeated again using bass, brook trout.

532. Snyder, Richard C. 1949. Vertebral counts in four species of suckers (*Catostomidae*). Copeia. No. 1: 62-65.

Vertebral counts were made on *Hypentelium roanokense* and *Hypentelium nigricans* (LaSueur) to determine the degree of differentiation that exists, if any, and to discover whether or not the reduction in number of scales of *H. roanokense* is paralleled by a reduction in vertebral number. Similar counts were made on *Catostomus c. commersonnii* (Lacepede), since these species also differ in scale counts, the latter having the smaller number in the lateral line.

The specimens used in this study were collected from the following localities: the 103 *Hypentelium roanokense* were from the upper Roanoke River system, Susquehanna, Lake Ontario, Tennessee and Ohio River systems; the 70 *Catostomus* c. *commersonnii* were from the upper Genesee River system; and the 41 *Catostomus* c. *catostomus* were from several drainages in northern New York State.

Soyugenc, M. - See: L. R. Hedrick, No. 243.

533. Sparling, J. H. and C. Nalewajko. 1970. Chemical composition and phytoplankton of lakes in Southern Ontario. Journal Fisheries Research Board Canada. 27: 1405-1428.

The phytoplankton of forty lakes in southern Ontario were examined and a species list was compiled. Some data from information on total volume of algae in Lake Ontario is compared.

534. Spiers, J. Murray. 1949. Great Lakes fishery research - Lake Ontario. Department of Zoology, Univ. of Toronto. 4 p. (Unpublished).

Contains a discussion of the correspondence made with Dr. Stone in Rochester concerning the work done by the New York State Conservation Department, the only organization outside of Ontario doing research connected with fisheries on Lake Ontario. (Univ. of Toronto, Zoology Library).

535 Speirs, J. Murray. 1954. The fight against the sea lamprey in the Great Lakes. Zoology Department, Univ. of Toronto. 9 p. (Unpublished).

The article discusses the lamprey; its physical characteristics, morphology, spawning habits, life cycle, different species and distribution. The problems that the lamprey cause to the fishing industry and possible solutions to eliminating the lamprey from the Great Lakes is mentioned. One such solution was the construction of barriers to the tributaries where the lamprey spawn. Another control method aimed at the ammocoetes was tried in 1954. This consisted of poisoning the larval beds and proved quite effective. (Univ. of Toronto, Zoology Library).

536. Speirs, J. Murray. 1955. Great Lakes Research Committee Progress Report for July, 1955. Toronto, Ontario. 33 p.

Presented in this paper are the results of biological investigation on the Great Lakes by the Great Lakes Committee. Concerning Lake Ontario, W. J. Christie reported results of tagging operations and recaptures. Gill netting for July produced only eight whitefish, many alewives and smelt. Commercial whitefish catches were samples. Results of investigations on the sea lamprey scar data showed an increase in scars and lampreys from 1954 to 1955 on whitefish. Fifty-eight percent of lake trout sampled had fresh sea lamprey scars. (Univ. of Toronto, Zoology Library).

Sreenivase, M. R. - See: H. C. Duthie, No. 137.

537. Sreenivasa, M. R. and H. C. Duthie. 1971. The identity of some diatoms common in the upper sediments of Lake Ontario. Abstract of paper presented at the 14th Conference Great Lakes Research, Toronto, Ontario. April 19-21, 1971. pp. 121-122.

Descriptions and measurements of diatoms from the upper sediments of Lake Ontario are given.

St. Remy, Nannette de - See: G. C. Toner, No. 555.

538. Stimpson, William. 1870. On the deep-water fauna of Lake Michigan. American Naturalist. 4(7): 403-405.

A look at the plants and animals living at the bottom of Lake Michigan. Contains a note on the occurrence of *Mysis* at Kingston, the highest point in the valley at which such shells have been found.

539. Stone, Frederick L. 1947. Notes on two darters of the genus *Boleosoma*. Copeia. No. 2: 92-96.

Two currently recognized subspecies of darters, *Boleosoma nigrum nigrum* (Storer) and *B. Nigrum olmstedi* (Rafinesque) have geographical ranges that overlap along the south shores of Lake Ontario and both forms are reported in the Allegheny-Chemung drainage. That the two groups should continue to be recognized as subspecies of a single species is somewhat dubious. Their ranges are compatible with their present status, but clear evidence of intergradation in their zone of overlap is lacking. Diagnostic key characters are examined by which specimens in the ranges of overlap can be readily assigned to one or the other subspecies.

540. Stone, Frederick L. 1948. A study of the taxonomy of the blue and yellow pikeperches (*Stizostedion*) of Lake Erie and Lake Ontario. Univ. of Rochester, Ph.D. Thesis. 164 p.

The main objective of this analysis was to determine the taxonomic relationships of the blue and yellow pikeperch in Lakes Erie and Ontario. Evidence was offered concerning their spawning habits and their bathymetric, ecological and geophysical distributions. In addition, an extensive study of their meristic and metric characters was made.

The blue pikeperch of both lakes belong to one species, while the yellow pikeperch of both lakes belong to another species. Thus, two separate species have been involved in this study.

541. Stone. Kivingston. 1883. Report of operations at the United States salmon-hatching station on M'Cloud River, California, during the season of 1880. U. S. Commission Fish and Fisheries, Report for 1880. Part 8, App. g: 597-621.

A table is included which shows the waters stocked, and tributaries where the fish were planted and the number of fish planted of young California salmon hatched from eggs taken in 1878.

With reference to Lake Ontario, a total of 12,200 fish were planted in its tributaries in 1879.

Stone, U. B. - See: J. V. Skiff, No. 518.

Stone, U. B. - See: Dwight A. Webster, No. 580.

542. Stone, Udell B. 1937. Growth, habits and fecundity of the ciscoes of Irondequoit Bay, New York. Transactions American Fish. Society. 67: 234-245.

This paper presents a study of ciscoes of Irondequoit Bay, New York, and deals with their migration, age and time of spawning, associated species at the time of spawning, predators and conservation. This study is based on the age determinations of 505 specimens, on the calculations of these ciscoes, and on the examination of the ovaries of 104 fish.

543. Stone, Udell B. 1944. A study of the deep-water cisco fishery of Lake Ontario with particular reference to the bloater *Leucichthys hoyi* (Gill). Transactions American Fish. Society. 74: 230-249.

Studies were made of the deep water cisco fishery on New York waters of Lake Ontario during the summer and fall of 1942. Experimental gill nets were set to test the 2-3/4 inch mesh, as provided under New York regulations, against various other mesh sizes to determine if changes in the regulations were advisable in order to increase the production of ciscoes. Conclusions are based on a total catch of 2,393 ciscoes of which 93.23% consisted of a single species, the bloater (*Leucichthys hoyi*). Characteristics of the different species of ciscoes and fishes associated with them were considered in formulating the recommendations. The catch of bloaters by the nets of each mesh size are analyzed with respect to number of fish taken, average length and weight, sex ratio and condition. Studies on the age and growth of the bloaters are presented. A change to 2-1/2 inch mesh was recommended for the deep water ciscoes provided that such nets are not fished in less than 180 feet of water.

544. Stone, Udell B. 1949. 1,000 Islands bass. New York State Conservationist. 3(6): 18-19.

A long-term study of the bass was begun in 1944 to provide information toward maintaining or improving management of the 1,000 islands bass fishing resource. To obtain information on migration and growth, over 3,000 bass were tagged and released at Chaumont Bay, Wilson Bay, head of Carleton Island, Sunnybank, Dodge Bay, Linda Island and Eel Bay.

545. Stone, Udell B. and Donald G. Pasko, Robert M. Roecher. 1954. A study of Lake Ontario-St. Lawrence River smallmouth bass. New York Fish and Game Journal. 1(1): 1-26.

A study of smallmouth bass of the eastern Lake Ontario-Thousand Islands region was carried on during 1944-50. Tagging of 4,408 wild adult bass at 10 principal localities was undertaken to determine if populations were homogeneous. Studies of age, growth and reproduction of the bass from different localities were made. Metal strap tags used on the dorsal fin and maxillary during 1944-45 gave recoveries of only 2.0% and 9.1%, respectively.

During 1946-50 round, metal strap tags, applied to the lower jaw, were used on a total of 2,853 fish. This method gave 612 recoveries (21.5%). Angling recoveries were used as an index to the catch of bass on various grounds during different months of the fishing season. Despite a relatively heavy take of bass on some grounds during June there was no evidence that the early fishing affected the population adversely. Heaviest returns, generally were in August. Distinct populations of bass were recognized using migrations and growth as the main criteria for separation. Four to 6 years are required in this area for bass to reach the legal length of 10 inches. The oldest bass found were 14 years old. Considerable variation in spawning time was found to be a characteristic of bass in this region. Late May to early June spawning occurred in tributary streams and in some of the warmer bays while late June-July spawning occurred among the fish influenced by the cold water of Lake Ontario.

Storr, John F. - See: Samuel J. Markello, No. 353.

546. Struthers, P. H. 1931. A review of the carp control problem in New York waters. New York State Conservation Department, Supplemental 21st Annual Report for 1930. Biological Survey. 6: 272-288.

Carp control studies conducted on carp infested waters of the State during the past five years yielded sufficient scientific evidence on which to base a policy of carp control. The investigations include field work on Oneida Lake, Barge Canal, Cayuga and Owasco Lakes, Seneca and Canandaigua Lakes, Saratoga, Crescent, Onondoga, Lonely and Irondequoit Bay.

The paper discussed the carp problem in our New York waterways and offers, as a solution to the problem, seineing the carp out of the waters. Included is a detail description of seineing operation, seineing net, and carp market.

547. Symons, G. E. and R. W. Simpson. 1938. Report on fish destruction in the Niagara River in 1937. Transactions American Fish. Society. 68: 246-255.

This paper reports on the studies made to determine the possible cause or causes of three epidemics of fish mortality which occurred during November and December, 1937, in the upper Niagara River. Samples of water and dead fish were analyzed to determine the lethal agent responsible for the slaughter. The source of pollution was indicated to be the Buffalo River, a grossly polluted stream receiving industrial and domestic sewage with very little flow. Combinations of wind velocity and direction rainfall and changes in lake level caused sudden discharges of the polluted waters of this stream into the Niagara River. At such times, the fish were observed to die. At the time of the three periods of fish mortality some extremely lethal agent seemed to be present that normally must be absent, because the fish mortality was so much greater than had ever been observed previously. (Canada Centre for Inland Waters).

548. Taudvin, J. W. 1910. Untitled. Ontario Game and Fish Department. 3rd Annual Report, 1909. pp. 35-36.

In the lower portion of Lake Ontario, the overseer noted that the bass fishing as a whole was not good. The spawning season was very late and very few bass had spawned before July 15, 1090. Also noted was that stormy weather may have been responsible. Many small bass were seen indicating good fishing next year. (Univ. of Toronto, Zoology Library).

Taylor, Grace - See: H. Kleerekoper, No. 318.

549. Tedla, Shibru and C. H. Fernando. 1969. Observations on the seasonal changes of the parasite fauna of yellow perch (*Perca flavescens*) from the Bay of Quinte, Lake Ontario. Journal Fisheries Research Board Canada. 26(4): 833-843.

The seasonal changes in incidence and intensity of infestation of yellow perch, *Perca flavescens*, by adult and larval parasites, both external and internal, were studied over a period of 1 year. Eight species of parasites were numerous enough to permit analysis of seasonal dynamics. *Bunodera luciopercae* and *Echinorhynchus slamonis* show a high infestation in the fall and declined gradually to zero by late summer. New infestation occurred in early fall. *Protocephalus pearsei* showed the highest incidence in summer and a lower level during the rest of the year without any marked fluctuations. The intensity of infestation remained relatively constant throughout the year. *Ergasilus confusus* reached its peak of incidence in the summer, declined through the fall and winter, and began increasing in spring. In February, however, both incidence and intensity were high.

Diplostomulum huronense showed a high intensity of infestation in November. The incidence remained fairly constant throughout the rest of the year. *Urocleidius adspectus* showed no seasonal variability as record to incidence but the intensity of infestation was highest in August and September. *Contracaecum spiculigerum* showed no distinct seasonal changes in incidence or intensity. Clochidial infestation of *Lampisilis radiata siliquoidea*. Brief life histories of the parasites whose seasonal changes of incidence and intensity were studied are included.

Tennant, Alan D. - See: Bernard J. Dutka, No. 139.

550. Tennant, Alan D., J. E. Reid, J. A. P. Bastien and R. M. Marion. 1966. The classification of coliform bacteria isolated from Lake Ontario. Dept. of National Health and Welfare, Division of Public Health Engineering, Kingston, Ontario. Manuscript Report No. 67-13. 23 p. + Appendix.

The present report concerns the biochemical classification of sheened coliform strains and includes a proposed classification scheme for coliform biotype identification based on standard "IMVEC" and gelatin-liquifaction tests.

From the data presented, it may be concluded that:

1. the low-density coliform flora of the off-shore Lake Ontario study area was characterized by a very high incidence of *Enterobacter* biotypes, a very low incidence of *Escherichia* biotypes and fecal coliform strains, and a relatively high incidence of gelatin-liquifying strains. This coliform biotype distribution pattern is considered to be typical of "remote" pollution originating from distant sources, and is probably of minimal public health significance.

2. there was a remarkable degree of uniformity in the coliform biotype distribution patterns found at all sampling depths in all sectors of the Lake; no significant sector-to-sector trends in coliform biotype incidence are apparent.

3. the fidelity of a fecal coliform test applied to Lake Ontario waters as an estimate of E. *coli* type I densities may be expected to be unusually low because of the relatively

high incidence of other EC (44.5°C) gas-positive coliform biotypes, principally Irregular 22.

4. atypical, slow-or non-lactose-fermenting strains constituted 12.1% of the 2,952 isolates from typical sheened coliform MF colonies.

5. only three enteropathogenic E. *coli* strains were isolated; all were from western Lake Ontario water samples with very low coliform MF counts.

6. irregular coliform biotypes were common in the coliform flora of the Lake. Ireegular strains may be conveniently identified through the application of the proposed coliform biotype classification scheme presented herein.

551. Tester, Albert L. 1930. Spawning habits of the small-mouthed black bass in Ontario waters. Transactions American Fish. Society. 60: 53-61.

The paper is a continuation of an investigation of the life history of the small-mouth black bass in Lake Nipissing and adjacent small lakes. Included is the geographical distribution of the small-mouthed black bass which includes Lake Ontario.

Thompson, R. E. - See: C. F. Schenk, No. 498.

Thompson, William Francis - See: David Starr Jordan, No. 304.

552. Tinsley, E. 1908. Enforcing laws and regulations. Ontario Game and Fisheries Department. 2nd Annual Report, 1908. pp. 5-81.

A general report on the present laws concerning fishing regulations during spawning times of the game and commercial fish. The author feels these laws are inadequate and he appeals to the authorities to re-evaluate the present fishing laws. (Univ. of Toronto, Zoology Library).

553. Toman, Frank A. 1955. White perch. New York State Conservationist. 10(1): 28.

The white perch although native to brackish water has been invading the fresh water of New York. It is noted that the white perch has been found in some tributaries of Lake Ontario, thought to be the result of unauthorized stocking of what were thought to be white bass. Some of the ecology and sport fishery aspects of this fish are presented.

554. Toner, G. C. 1934. Notes on the alewife. Canadian Field Naturalist. 48(3): 51-52.

A discussion as to whether the alewife, *Pomolobus pseudoharengus*, was planted, migrated or native to Lake Ontario.

555. Toner, G. C. and Nannette de St. Remy. 1941. Amphibians of eastern Ontario. Copeia. No. 1: 10-13.

A list by species of the amphibian fauna of the south-eastern part of Ontario is given. *Necturus maculosus maculosus* (Rafinesque) was noted at Kingston, in Lake Ontario and at Gananoque in the St. Lawrence River. *Rana catesbeiana* Shaw was noted in the Gananoque River and the St. Lawrence River.

556. Toronto Department of Public Works. 1921. Water Supply Section. Report on the chemical, physical and bacteriological survey of Lake Ontario water. Toronto Dept. of Public Works, Toronto, Ontario. 15 p. mimeo.

The following is a report of a chemical, physical and bacteriological survey of Lake Ontario, in the vicinity of Toronto, made to determine the most suitable location for the installation of an intake pipe to supply raw water.

The number of bacteriological examinations carried out during the survey period amounted to 7,906. Average bacterial counts/c.c. listed for agar and acid-forming colonies and also number of *B. coli* was given.

The bacteriological quality of the water at all points was directly affected by the prevailing winds and the figures were presented in a table.

557. Townsend, C. H. 1899. Report of the Division of Statistics and Methods of the fisheries. U. S. Commission Fish and Fisheries. Report for 1898, Part 24. pp. 147-175.

Included in this paper is a section on the fisheries of Lake Ontario. A table showing the comparative yield of the fisheries of Lake Ontario in 1880, 1885, 1890, 1893 and 1897 is given. Also shown in tabular form is (1) the yield by county and species for 1897 and (2) the vessels, boats, apparatus and shore property per county employed in the fisheries of Lake Ontario in 1897.

Tressler, Willis L. - See: P. R. Burkholden, No. 83.

558. Tressler, Willis L. and Thomas Austin. 1939. A limnological study of some bays and lakes of the Lake Ontario watershed. NYS Conservation Dept., Supplemental 29th Annual Report for 1939. Biological Survey. pp. 188-210.

During the summer of 1939 a number of bays and lakes of the Lake Ontario watershed were investigated to determine the amount and quality of microscopic life, the environmental conditions under which this life existed and the extent to which fish were utilizing this important food element in their diet. Vertical series at several depths were made in the water areas studied during the months of July and August. Four bays were found to produce much more plankton than the lake itself. The stomachs of perch and large-mouthed bass from Irondequoit Bay contained a greater amount of plankton than the same species from Sodus Bay.

559. Tressler, Willis L., Thomas Austin and Edward Orban. 1953. Seasonal variation of some limnological factors in Irondequoit Bay, New York. American Midland Naturalist. pp. 878-903.

During the summer of 1939, a series of samples were taken in the deeper part of Irondequoit Bay as a part of the general Biological Survey of the Lake Ontario watershed conducted by the New York Conservation Dept. (Tressler and Austin, 1940). The results of this mid-August sampling indicated a high degree of productivity and extreme stagnation conditions which prompted the continuation of these studies during the following year. An extensive program of independent investigations was begun in September 1939 and was continued at monthly intervals until June 1940. Series of samples at various depths were taken monthly to determine the seasonal variations in physical, chemical and biological factors.

560. True, F. W. 1887. The fisheries of the Great Lakes. In: Good, G. B. (Ed.). The fisheries and fishery industry of the United States, Section II. pp. 631-673.

A statistical summary is listed of the number of people employed, the capital invested and apparatus employed, as well as the quantities and values of the products derived from Lake Ontario in 1879. There is very little fishing carried on at the western end of the lake and the few fish caught are taken by fishermen for their own consumption. The only fisheries which are of commercial importance are situated at the east end of the lake, near the head of the St. Lawrence River.

The fishing at the eastern end of the lake is described including an inventory ofthe equipment and its value at various parts and losses which have occurred.

561. Tucker, Allan. 1948. The phytoplankton of the Bay of Quinte. Transactions American Microscopical Society. 67(4): 365-383.

This paper presents a quantitative and qualitative study of the phytoplankton of the Adolphus Reach region of the Bay of Quinte. Physical and chemical factors such as wind, thermal stratification of water, transparency and dissolved oxygen were considered as important and were measured. The major phylum of algae in order of abundance were chrysophyta, cyanophyta, chorophyta and pyrrophyta. Three peaks in phytoplankton abundance occurred during the summer, on June 12, July 9 and August 9. These peaks of abundance occurred in the upper water and were made up respectively of diatoms on June 12, diatoms and green algae on July 9 and blue greens on August 9. It is shown in this investigation that each peak of abundance appeared in the upper water and tended to become distributed uniformly from surface to bottom by the stirring action of the water. The maximum abundance of phytoplankton during the summer occurred on July 9 and the minimum of July 31. The important forms of diatoms in order of abundance were *Melosira tabellaria* and *Fragilaria*. The blue greens were made up mostly of Aphanizomenon and to a lesser degree *Microcystis*. The only green algae of significance was *Mougeotia*. A quantitative and qualitative comparison of the Bay of Quinte and Lake Erie is discussed. It was noted that not enough time was allowed for the study to determine the real picture included the pulses, times, species and abundance.

562. Tucker, Allan. 1949. Pigment extraction as a method of quantitative analysis of phytoplankton. Transactions American Microscopical Society. 68(1): 21-33.

Various concentrations of *Ankistrodesmus* were used in a laboratory experiment to find the abundance of phytoplankton by a colorimetric determination of the density of the pigment. The pigment extraction method was then compared with the enumeration method.

563. Tybout, R. A. 1967. Systems analysis: An economists view. Systems Approach to Water Quality in the Great Lakes. Proceedings 3rd Annual Symposium on Water Resources Research. Ohio State University Water Resources Center. pp. 117-126.

The term "systems analysis" connotes whatever concept of propriety seems appropriate in the diagnosis of water management problems. This paper presents the interdependencies of particular kinds of water quality management as seen by an economist. An input-output model is derived for the problem of water quality control in a lake or estuary such as Lake Erie or Ontario in which a series of equations are applied by subdividing the lakes into basins that have relatively homogenous quality characteristics. A system of Optimization Criteria and another system of Cost-Benefit Analysis are also developed since each possesses a complicated set of interdependencies and focuses on the resolution of a particular problem.

564. Ulrich, Edward C. 1952. Harlequin duck in the Western New York region. Prothonotary. 18(9): 65.

Presented in this paper is a description of the habitat on the Harlequin duck, *Histrioncus histrionicus histrionicus*, and a history of observations on it since 1902 in the Niagara River.

565. U. S. Fish Commission. 1882. Memorandum of some results of the artificial propagation and planting of fish, due mainly to the efforts of the United States Fish Commission. Bulletin U. S. Fish Commission for 1881. 1: 208-215.

Specimens illustrating successful introduction of important species are recorded in this article.

A specimen of quinnat or California salmon (*Oncorhynchus chouicha*) was caught from Lake Ontario on July 1878, weighing 14 lbs.

566. U. S. Commission on Fish and Fisheries. 1895. Mortality among alewives, Lake Ontario. Report of the Commissioner. 19: 49-50.

A discussion of the observations of Dr. R. R. Gurley of the death of alewives of Nine-Mile Point, Wilson, Charlotte and Cape Vincent during the spring and summer of 1863. Noted that die-off occurred initially in April or late March, reached its maximum in May and decreased through August. Noted that dead fish had patches of saprolegnia. No other parasites were observed on the fish.

567. U. S. Fish and Wildlife Service. 1969. Fish and Wildlife as related to water quality of the Lake Ontario basin. Fish and Wildlife Service, Washington, D. C. 128 p.

A brief section concerning the plankton and benthic organisms is included in the description of the Lake Ontario basin. The major portion of the report, however, deals with the Lake Ontario fishery in relation to water quality. The fish and wildlife resources, economic aspects of sport fishing, hunting and commercial fishing, water quality aspects as affecting fish and wildlife, management, and research requirements are all discussed.

568. Vanderpost, J. M. and B. J. Dutka. 1971. Bacteriological study of the Kingston basin sediments. Abstract of paper presented at the 14th Conference Great Lakes Research, Toronto. April 19-21, 1971. pp. 71-72.

Since there was no record of any bacteriological studies of the sediments in the Kingston basin and the St. Lawrence River outlet of Lake Ontario, a program of sediment analyses designed to present detailed bacteriological information about the outflow environment of Lake Ontario was initiated.

The bacteriological parameters used were: coliform MF; 20°C MF plate count; 20°C MF anaerobic plate count; sulphate-reducing bacteria MPN; sulphur-oxidizing bacteria MPN; nitrifying bacteria MPN; autotrophic ammonium-oxidizing bacteria MF and dehydrogenase activity.

569. Van Oosten, John. 1935. First record of the alewife, *Pomolobus pseudoharengus*, for the State of Michigan. Copeia. No. 4: 194-195.

The above is essentially on the occurrence of the alewife in Michigan. It includes, however, a note on its common occurrence in Lake Ontario and the St. Lawrence. Also mentioned is the fact that it forms an important item in the diet of lake trout and burbot in Lake Ontario.

570. Van Oosten, John. 1936. The dispersal of smelt, *Osmerus mordax* (Mitchell), in the Great Lakes region. Transactions American Fish. Society. 66: 160-176.

The phenomenal spread of the introduced smelt, *Osmerus mordax* (Mitchell), throughout the Great Lakes region during the past decade will be referred to repeatedly in the years to come as another classic example illustrating the many complications that follow the successful establishment of an exotic species of fish. Here are presented in chronological order and by Great Lakes drainages the data of first appearance or of first smelt runs at various localities, together with brief notes on abundance and other items of interest and the source of the record.

571. Van Oosten, John and H. J. Deason. 1937. The food of the lake trout (*Cristivomer nunaycush namaycush*) and of the lawyer (*Lata naculosa*) of Lake Michigan. Transactions American Fish. Society. 67: 155-177.

This paper reports on a qualitative and quantitative analysis of the contents of 4,979 lake trout stomachs collected in 1931 from southern Lake Michigan. Included is a brief reference to Dymond (1928) who studied the food of 128 lake trout and 64 lawyers from Lake Ontario. He found that in early summer the dominant food of the trout was the alewife, a species which does not occur in Lake Michigan and in late summer the ciscoes.

572. Van Otterloo, H., J. B. Bell and B. J. Dutka. 1967. A bacteriological study of Lake Ontario, conducted for the advisory board on water pollution, International Joint Commission. Dept. of National Health and Welfare, Division of Public Health Engineering, Kingston, Ontario. Manuscript Rept. No. 67-20. 136 p.

A water quality study of Lake Ontario was conducted by the Kingston Branch of the Public Health Engineering Division, Dept. of National Health and Welfare, from June 12 to November 2, 1967. This study was a continuation of a program begun in 1966.

Data collected during this study supports the belief that the main body of Lake Ontario water is not polluted. The majority (39 of 62) of monitor stations recorded coliform MF master medians of less than 1 (Fig. 3); only 6 stations, located in the Toronto and Niagara River areas, recorded coliform MF master medians of 6 or more coliforms per 100 ml.

The Niagara River is one of the major contributors of bacteriological pollution into Lake Ontario. The highest coliform MF, fecal coliform MF and fecal streptoccoccus MF master medians were recorded at monitor and intensive study stations in the Niagara River area. Comparison of the 35°C and 20°C standard plate count data, from the Niagara River area, illustrate that 35°C standard plate count master medians were double the 20°C master medians, an indication that sewage pollution is a contributory factor in the degradation of inshore waters in this area.

Data present in this report indicate that the Toronto and Rochester areas may in the future present bacteriological pollution problems; however, the pollution areas appear to be limited to waters within 2 miles of shore.

Comparison of data obtained from Lake Ontario and Lake Erie (Menon, et.al., 1967) indicate that the highest coliform MF counts, obtained from Lake Ontario water samples, were not nearly as high as the highest counts recorded from Lake Erie samples. Several Lake Erie stations yielded coliform MF counts in the thousands, with Toledo Harbour recording the highest coliform MF master median (6,500); in comparison, the highest coliform MF count recorded in Lake Ontario was 1,500 (station 12, Niagara River) and the highest coliform MF master median was 87 (station III, Niagara River).

Figure 3 and 4, indicate that the main body of Lake Ontario and Lake Erie water cannot be considered to be polluted. However, both lakes have in-shore areas which range from mildly to grossly polluted and amongst these inshore areas, the degree of pollution is greater in Lake Erie than in Lake Ontario. (Rochester-EPA).

573. Ver Duin, Claude. 1950. Beware of the gizzard shad. Fisherman. 18(3): 4.

The article discusses the appearance of the gizzard shad in Lake Ontario and the destruction that it caused to the food supply of the whitefish and herring. The fishermen are now witnessing the spread of the shad into Lake Erie which means that the food supply of the herring and whitefish will be in danger. The author ends the article by warning the conservation officials to keep a close check on the shad and to take steps to eradicate them before they become a menance to the native fish of the lakes. (Univ. of Toronto, Zoology Library).

574. Vladykav, V. D. and G. N. Mukerji. 1961. Order of succession of different types of infraoral lamina in landlocked sea lamprey (*Petromyzon marinus*). Journal Fisheries Research Board Canada. 18(6): 1125-1143.

Infraoral lamina were studied of 630 lampreys from Lake Erie, Ontario, Lake Seneca, New York and the Pere Marquette River, Michigan. The main types of lamina are listed and described. In adults, feeding in lakes, the predominant type is the inclined lamina. In spawning specimens the normal lamina is most characteristic. Newly transformed lampreys and others less than 180 mm long have normal lamina. The rosebud lamina is characteristic of half grown specimens. Thus, the usual succession throughout life is normal, rosebud, inclined and finally normal again. (Toronto Ontario Fisheries Research Library, Zoology Library).

575. Wagner, F. E. 1928. Chemical investigation of the Oswego watershed. NYS Conservation Dept., Supplemental 17th Annual Report. A Biological Survey of the Oswego River System. pp. 108-122.

The chemical characteristics of the watershed were analyzed and these factors were used in some cases to compare with the biological conditions of the water at the point. Dissolved oxygen profiles were taken throughout the Oswego watershed and the reduction of dissolved oxygen was associated with human industrial and domestic pollution which resulted in the reduction or extermination of fish from these areas.

Walker, Boyd W. - See: Carl L. Hubbs, No. 267.

576. Walker, Bryant. 1918. A synopsis of the classification of the fresh-water mollusca of North America, North of Mexico and a catalogue of the more recently described species with notes. Univ. of Michigan, Zoology Museum, Miscellaneous Publications, No. 6, Part II Catalogue 93: 213.

The paper lists diagnostic characteristics, geographical occurrence and distribution of molluska in the United States, North of Mexico. Mentioned occurring in Lake Ontario was *Valvata piscinalis* Muller and found in the Niagara River was *Pyrgulopsis letsoni*.

577. Ward, Lester F. 1883. Marsh and aquatic plants of the northern United States, many of which are suitable for carp ponds. Bulletin U. S. Fish Commission for 1883. 3(17): 257-265.

Contains a list of the marsh and aquatic plants and their occurrence which would be suitable for carp ponds. Those plants listed as occurring in Lake Ontario are *Ranunculus flammula* L., *Nelumbium luteum* Willd., *Myriophyllum heterophyllum* Michx., *M. tenellum*, *Limnobium spongia* Richard, *Potamogeton magarensis* Tuck. (rapids above Niagara Falls), and *Scirpus Smithii*.

578. Watson, Henry. 1909. Untitled. Ontario Game and Fish Department. 2nd Annual Report, 1908. pp. 20-21.

The overseer at Toronto reports that the net fishing during the past season was about the same as the season prior to this past season last due to a very stormy year. Very little illegal fishing was attempted. Rod fishing did not improve around Toronto. The large amount of deleterious matter poured into Ashbridge's Bay and Toronto Bay have driven even the carp away. It is also noted sportsmen were not opposed to the license fee for fishing by rod. (Univ. of Toronto, Zoology Library).

579. Waure, M. and Ralph O. Brinkhurst. 1971. Interactions between some tubificid olegochaete and bacteria found in the sediments of Toronto Harbour, Ontario Journal Fisheries Research Board Canada. 28: 335-341.

Studies on the biology of tubificid olegochaetes have indicated that the nature of the food available to the worms may be a primary factor in determining the distribution and abundance of species.

Three species of tubificid olegochaetes and seven heterotrophic aerobic bacteria were identified from the sediments of Toronto Harbour, Ontario. The relative abundance of the identifiable bacteria present in the mud and in the worm feces voided after 18 hrs. was established using nutrient agar medium. The results indicated a reduction in the relative abundance of bacteria by about 72% and a reduction in the variety of bacteria in the feces and guts of the worms, whereas all seven were shown to be ingested at one time or another.

The results suggest that the fraction of the bacterial flora investigated forms a part of the diet of tubificids and that differences between worm speices in relation to their use of those bacteria may help to explain the survival of a number of morphologically unspecialized sediment-feeding species in close physical proximity to each other.

580. Webster, Dwight A., Udell B. Stone, Donald Pasko and John L. Forney. 1959. Migration habits of smallmouth bass. New York State Conservationist. 13(6): 4-8.

The movements of smallmouth bass are described and charted in four of the major fishing waters of New York State. The waters charted are the eastern Lake Ontario - Thousand Islands region, the St. Lawrence River and Lake St. Lawrence, Oneida Lake and Cayuga Lake.

581. Webster, J. S. 1908. Fishery laws. Stocking depleted waters. Ontario Game and Fish Department. 1st Annual Report, 1907. pp. 14-16.

A report by Acting Inspector J. S. Webster on the status of the fishing laws in Canadian waters, especially the Bay of Quinte. Also mentioned is the stocking of depleted waters with parental bass--only the stocking was done in a poor way and most of the bass died. The Author recommends a solution to the stocking problem. (Univ. of Toronto, Zoology Library).

Weeks, D. H. - See: J. V. Skiff, No. 518.

582. Wells, L. 1969. Fishery survey of U. S. waters of Lake Ontario limnological survey of Lake Ontario, 1964. Great Lakes Fishery Commission. Technical Report No. 14. 59 p.

Gill nets and trawls were fished by the Bureau of Commercial Fisheries R/V CISCO during September 19-23, 1964, at several locations and depths in the offshore United States waters of Lake Ontario. Water temperatures were very low (3.7-8.3°C) at all fishing stations except one (16.4°C). Supplementary data were provided by the Bureau's R/V KAHO in 1966. Alewives and smelt were common. Ciscoes were extremely scarce, but large; most of those caught were bloaters. Slimy sculpins were abundant, but no deepwater sculpins were caught. Yellow perch were scarce. Although the warm water species were inadequately sampled, trout-perch seemed to be abundant. Other species, all caught in small numbers, were lake trout, spottail shiners, burbot, threespine sticklebacks and johnny darters from cold water and northern pike, lake chubs, white suckers, white bass, white perch and rock bass from warm water.

Weed, Alfred C. - See: Barton A. Bean, No. 47.

Werner, W. H. R. - See: H. H. MacKay, No. 344.

583. Westerman, F. A. 1932. The deep water trap net and its relation to the Great Lakes fisheries. Transactions American Fish. Society. 62: 64-71.

The introduction of the deep water trap within the past few years has caused great deal of concern to commercial fishermen and to conservation officials. A description of the dimensions of these nets and the mesh of the nets is given. Some lake trout are taken in these nets but they are primarily a whitefish net. The tremendously expanded field in which trap nets operate has brought them into keen competition with the gill netters. Deep water trap nets appear to have been used first in Lake Ontario at Cape Vincent and in Chaumont Bay.

584. Westman, J. R. and W. E. Fahy. 1940. A biological survey of the Lake Ontario watershed. X. The carp problem of the area. New York State Conservation Dept., Supplemental 29th Annual Report for 1939. Biological Survey. pp. 226-231.

The presence of dense populations of carp, *Cyprinus carpio*, in many of New York's lakes and ponds has long been recognized as a fisheries problem. Interest in seineing as a possible means of control is held by many anglers in regions where the species is troublesome;

and commercial seineing, while influenced by several limiting factors, provides some means for obtaining information on carp populations, as well as furnishing a way to find out what value, if any, seineing possesses as a method of carp control.

585. Williams, L. G. 1966. Dominant planktonic rotifers of major waterways of the United States. Limnology and Oceanography. 11(7): 83-91.

Plankton samples were taken at 128 sampling stations on the major rivers and Great Lakes of the United States. It was found that the rotifers were the most numerous metazoons found in the plankton samples. The sampling sites in the Great Lakes region included the Niagara River which had 9 different genera of rotifers.

586. Wilmot, Samuel. 1877. California salmon in Lake Ontario. Forest and Stream. 8: 419.

Contains a note on the occurrence of a California salmon in the estuary of Wilmot's Creek in Lake Ontario followed by a relatively complete description.

587. Wilmot, Samuel. 1879. Notes on the western gizzard shad, *Dorosoma cepedianum heterurum*, (Raf.) Jordan. Proceedings U. S. National Museum. 1: 263-264.

Comment on the phenomenon of the superabundance of the western gizzard shad throughout the length of Lake Ontario followed by their sudden disappearance. The fish had become so numerous that people were able to dip them out with their hats.

588. Wilmot, Samuel. 1881. Remarks on the scarcity of male and grilse salmon in the rivers of Ontario, Canada. Bulletin U. S. Fish Commission. 1: 379-381.

Note on the overabundance of females and scarcity of males. They found enough females to yield 250,000 eggs but couldn't find a single male to impregnate the eggs. Also notes that there are no grilse salmon around.

589. Wilmot, Samuel. 1882. Introduction of California salmon into Ontario, with remarks on the disappearance of Maine salmon from that province. Bulletin U. S. Fisheries Commission. 1: 347-349.

A letter to the Commission in which Wilmot notes his experiences with the restocking of streams that flow into Lake Ontario. Also mentions that pollution from barn-yards, plowed fields, turnpike roads, saw-mills and factories has eliminated for the best part young salmon and trout from these waterways. Also notes that his initial introduction of carp have been quite successful. He requested more carp to stock these streams.

590. Wilson, Charles Branch. 1877. The economic relations, anatomy and life history of the genus *Lernaea*. Bulletin U. S. Bureau Fisheries for 1915-1916. 35: 163-198.

Contained within this paper is a complete biological study - history, ecology, external and internal morphology, embryonic development and systematic classification with key and taxonomic descriptions - of the genus *Lernaea*.

In the systematic section, the following reference to Lake Ontario was made:

> *Lernaea tortua* (Kellicott), 1881. Found in tumors upon the external surface of the bullhead, *Ameiurus nebulosus*, in Grindstone Creek near Lake Ontario.

Wilton, R. - See: H. Kleerekoper, No. 318.

Winter, Wolfgang - See: Bernard J. Dutka, No. 140.

591. Wood, R. D. and W. C. Muenscher. 1956. The characeae of the State of New York. Memoir 338. Cornell University Agricultural Experimental Station. 77 p.

There are many species of characeae in New York State including ones in the genera *Chara, Nitella* and *Tolypella*. Keys for identification, descriptions of morphology and taxonomy, illustrations and maps of distribution of the characaeae of New York is included.

592. Wright, A. H. 1918a. Fish succession in some Lake Ontario tributaries. Scientific Monthly. 7: 535-544.

This paper presents a study of ten streams flowing into Lake Ontario in Monroe County, N. Y. It is an attempt to study fish succession by a comparison of these streams with others both different and similar in geologic time of origin. The first inhabitants of a newly formed stream were determined to be the sucker, horned dace and the black-nosed dace. From data on species composition of these streams an extensive list of fish succession to arrived at according to which the walleye and two-spined stickleback would be the last arrivals. It is mentioned that these lists may be speculative and that mans activities such as construction of canals may have falsified the record of fish succession.

593. Wright, A. H. 1918b. Fish succession in the water courses of Lake Ontario. Copeia. No. 53: 10-11.

The article traces the various fish inhabiting each stage in the succession of a stream. It begins with those species living in a rivulet or small creek, progresses to those forms living under muddy conditions and finally describes the "swift-gravelly" group.

594. Wright, Ramsay. 1891. Preliminary report on the fish and fisheries of Ontario. Ontario Game and Fish Commission. Commissioners Report. pp. 419-476.

The first section of the report deals with the geographical considerations likely to affect the distribution of the various species of fish occurring within the waters of the Province. This is followed by a short account of the natural history of fish and the natural history of the species of fish reported from the Province. This includes the physical characteristics of the fish, habitat, spawning behaviour and food.

The last portion of the report gives statistics on the fishing industry, number of fishermen, type of fishing material used, boats, tugs and the economic value of each major species to the commercial industry. (Univ. of Toronto, Zoology Library).

Yalkovsky, R. - See: A. M. Cairo, No. 85.

Yurack, J. - See: B. J. Dutka, No. 141, 142.

595. Zenkert, Charles A. 1934. The flora of the Niagara Frontier region. Bulletin Buffalo Society Natural Science. 16: 328.

This book presents information pertaining to the ferns and flowering plants of Buffalo, N. Y. and vicinity. Included is information of the abundance and distribution of flowering aquatic plants in the Niagara River and nearby Lake Ontario noting sites of collection.

596. Zimmerli, W. H. 1934. The lake plains waterfowl association takes a real part in duck management. Goshawk. 7(2): 48.

This report contains articles describing activities of the Lake Plains Waterfowl Association, of the Genesee Ornithological Society and contains records of the months sightings along the marshes and ponds bordering Lake Ontario.

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